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Autonics
Sensors & Controllers

## High accuracy standard temperature controller

# TK Series

## USER MANUAL

Thank you very much for selecting Autonics products.
**For your safety, please read the following before using.**

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# Preface

Thank you for purchasing an Autonics product.

Please familiarize yourself with the information contained in the Safety Precautions section before using this product.

This user manual contains information about the product and its proper use, and should be kept in a place where it will be easy to access.

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# User Manual Guide

- Please familiarize yourself with the information in this manual before using the product.
- This manual provides detailed information on the product's features. It does not offer any guarantee concerning matters beyond the scope of this manual.
- This manual may not be edited or reproduced in either part or whole without permission.
- A user manual is not provided as part of the product package.
  Visit our web site (www.autonics.com) to download a copy.
- The manual's content may vary depending on changes to the product's software and other unforeseen developments within Autonics, and is subject to change without prior notice.
  Upgrade notice is provided through out homepage.
- We contrived to describe this manual more easily and correctly. However, if there are any corrections or questions, please notify us these on our homepage.


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# User Manual Symbols

| Symbol | Description |
|---|---|
| Note | Supplementary information for a particular feature. |
| Warning | Failure to follow instructions can result in serious injury or death. |
| Caution | Failure to follow instructions can lead to a minor injury or product damage. |
| Ex. | An example of the concerned feature's use. |
| ※1 | Annotation mark. |

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# Safety Precautions

- Following these safety precautions will ensure the safe and proper use of the product and help prevent accidents, as well as minimizing possible hazards.
- Safety precautions are categorized as Warnings and Cautions, as defined below:

| | | |
|---|---|---|
| Warning | **Warning** | Failure to follow the instructions may lead to a serious injury or accident. |
| Caution | **Caution** | Failure to follow the instructions may lead to a minor injury or accident. |

## Warning

- In case of using this unit with machinery (Ex: nuclear power control, medical equipment, ship, vehicle, train, airplane, combustion apparatus, safety device, crime/disaster prevention equipment, etc) which may cause damages to human life or property, it is required to install fail-safe device.
  It may cause a fire, human injury or damage to property.
- Install the unit on a panel.
  It may cause electric shock.
- Do not connect, inspect or repair when power is on.
  It may cause electric shock.
- Wire properly after checking terminal number.
  It may cause a fire.
- Do not disassemble the case. Please contact us if it is required.
  It may cause electric shock or a fire.

## Caution

- This unit shall not be used outdoors.
  It might shorten the life cycle of the product or cause electric shock.
- When connecting wire, AWG 20(0.50mm²) should be used and screw bolt on terminal block.
  It may cause a malfunction or fire due to contact failure.
- Please observe the rated specifications.
  It might shorten the life cycle of the product and cause a fire.
- Do not use beyond of the rated switching capacity of relay contact.
  It may cause insulation failure, contact melt, contact failure, relay broken and fire etc.
- In cleaning unit, do not use water or an oil-based detergent and use dry towels.
  It may cause electric shock or a fire.
- Do not use this unit in place where there are flammable or explosive gas, humidity, direct ray of the light, radiant heat, vibration and impact etc.
  It may cause a fire or an explosion.
- Do not inflow dust or wire dregs into the unit.
  It may cause a fire or a malfunction.


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- Please wire properly after checking the terminal polarity when connecting temperature sensor.
  It may cause a fire or an explosion.

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# 1 Product Introduction

## 1.1 Features

TK Series – standard PID temperature controller – realizes more powerful control with super high-speed sampling cycles of 50 ms and ±0.3% display accuracy. It supports diverse control modes including heating & cooling simultaneous control, and automatic/manual control and communication functions. In addition, TK Series covers all necessary features for high performance temperature controllers – that is, diverse input sensor support, multi SV setting, SSR drive output + current output, high resolution display and compact size.

- Improves convenience for parameter setting (using DAQMaster)
  - Parameter mask
    To hide parameters which are not unnecessary or not used frequently
  - User parameter group
    To group parameters which are used frequently as one group for more convenient setting
- Super high-speed sampling cycle (10 times faster compared to existing models);
  50 ms sampling cycle and ±0.3% display accuracy
- Improved visibility with wide display and high luminance LED
- High performance control with heating & cooling control and automatic/manual control modes
- Communication function supported: RS485 (Modbus RTU type)
- PC parameter setting (USB and RS 485 communication)
  Free download integrated device management program (DAQMaster)

  ※Communication converter, sold separately
  SCM-US(USB to Serial converter), SCM-38I(RS232C to RS485 converter),
  SCM-US48I(USB to RS485 converter)
- SSR drive output/current output selection function
- ON/OFF, Cycle, Phase control by SSRP function
- Heater burn-out alarm (CT input) (except TK4SP)

  ※CT, sold separately: CSTC-E80LN, CSTC-E200LN
- Multi SV setting function (Max. 4 ) – selectable via digital input terminals
- Space saving mounting possible with compact design ; downsized by 38% (depth-based)
- Multi-input/multi-range

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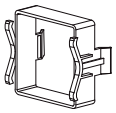
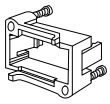
## 1.2 Components and Accessories

### (1) Components

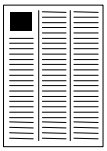
TK Series



TK4S/SP only



TK4N only



User manual

Bracket

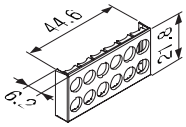
**Note**

Make sure all of the above components are included with your product package before use.
If a component is missing or damaged, please contact Autonics or your distributor.
Visit www.autonics.com to download a copy of the user manual.

### (2) Sold separately

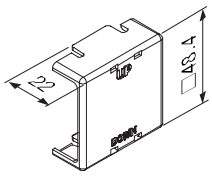
▪ Terminal cover (unit: mm)

● **TK4N-COVER (48×24mm)**

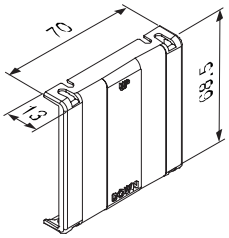



※The cover for TK4N is an acessory.

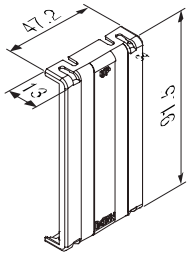
● **RSA-COVER (48×48mm)**



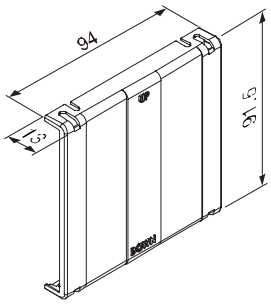

● **RMA-COVER (72×72mm)**




● **RHA-COVER (48×96mm, 96×48mm)**




● **RLA-COVER (96×96mm)**





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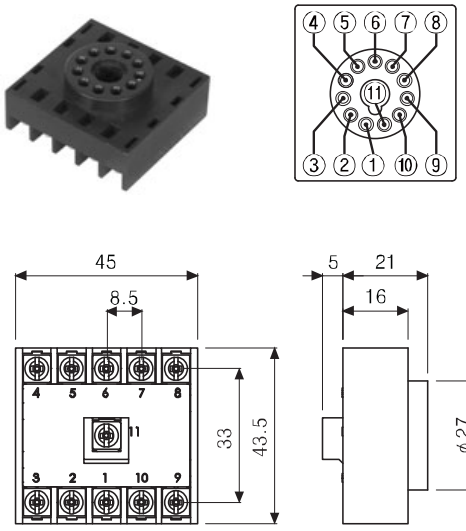
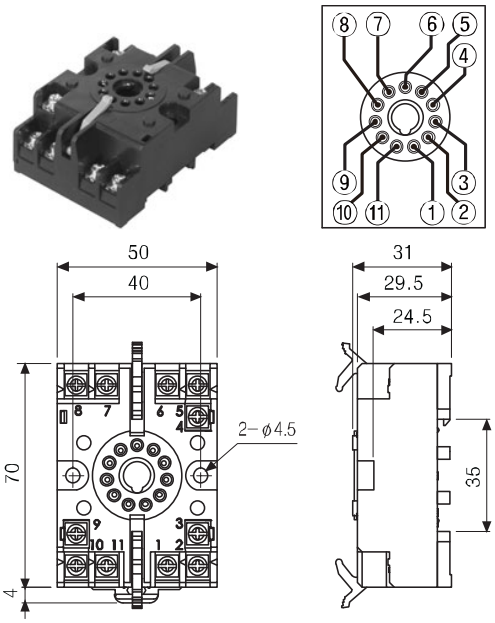
- Socket (for TK4SP) (unit: mm)

| PG-11 | PS-11 |
|---|---|
|  |  |

- Communication converter

| SCM-38I<br>(RS232C to RS485 converter) | SCM-US48I<br>(USB to RS485 converter) | SCM-US<br>(USB to Serial converter) |
|---|---|---|
| | | |

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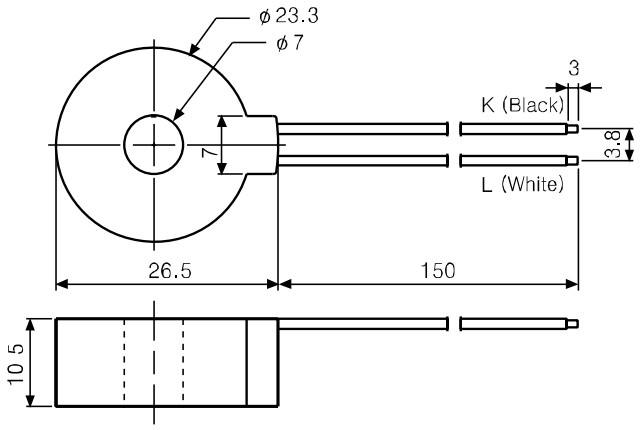
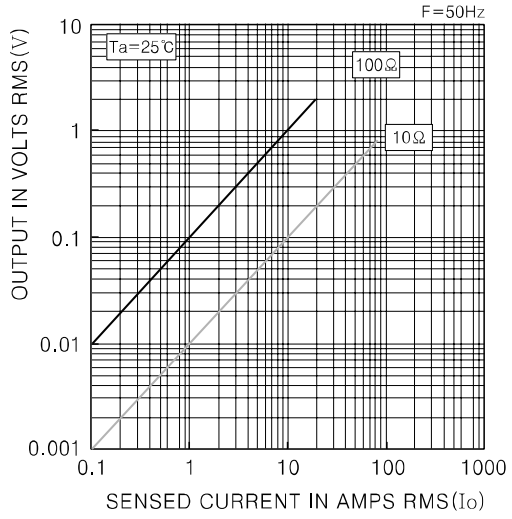
- Current transformer(CT)

| CSTC-E80LN |
|---|
| • Max. load current: 80A(50/60Hz)<br>※Max. load current for TK4 Series is 50A.<br>• Current ratio: 1/1000<br>• Wire wounded resistance: 31Ω ±10%<br>(unit: mm)<br>  <br>  |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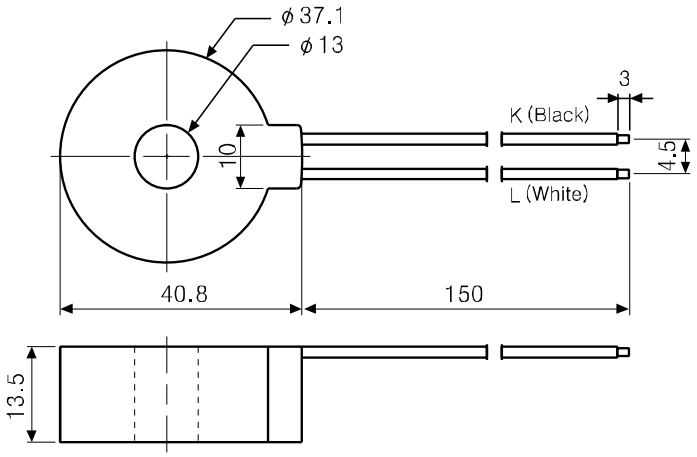
CSTC-E200LN

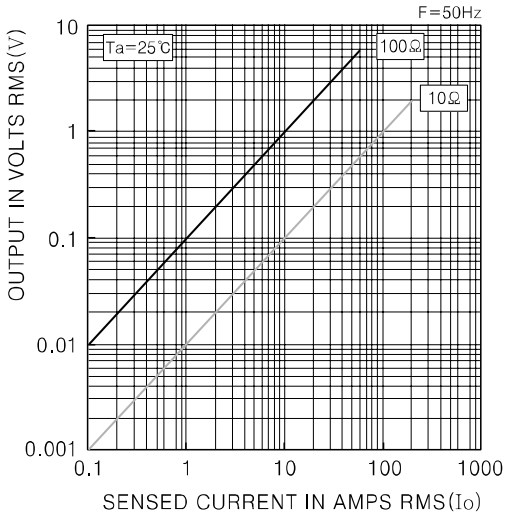
- Max. load current: 200A(50/60Hz)

※Max. load current for TK4 Series is 50A.

- Current ratio: 1/1000
- Wire wounded resistance: 20Ω±10%

(unit: mm)




## Note

Images of components and accessories may differ from actual products.

For detailed information about any of the above products, please refer to the concerned product's user manual.

Visit our website (www.autonics.com) to download copies of the user manuals.

## Caution

For using CT, do not supply first part current when opening CT output.
It occurs high voltage at CT output part.

Using current of above two CTs are same as 50A. But be sure that inner hole sizes are different.
Select it properly for the environment.

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## 1.3 Ordering information

| TK | 4 | S | - | 1 | 4 | R | R |
|---|---|---|---|---|---|---|---|
| ① | ② | ③ | | ④ | ⑤ | ⑥ | ⑦ |

| Category | | | Description |
|---|---|---|---|
| ① Item | TK | | Temperature/Process controller |
| ② Digit | 4 | | 9999(4digit) |
| ③ Size | N | | DIN W48×H24mm |
| | SP | | DIN W48×H48mm (11 pin plug type※7) |
| | S | | DIN W48×H48mm (terminal block type) |
| | M | | DIN W72×H72mm |
| | W | | DIN W96×H48mm |
| | H | | DIN W48×H96mm |
| | L | | DIN W96×H96mm |
| ④ Input/Output Option※1 | N | 1 | Standard: Alarm output 1+CT input※4,<br>Heating&Cooling: Alarm output 2※5 |
| | | 2 | Standard: Alarm output 1+Alarm output 2 |
| | | D | Standard: Alarm output 1+Digital input(DI-1, DI-2) |
| | | R | Standard: Alarm output 1+Digital input, Heating&Cooling: Trans. output |
| | | T | Standard: Alarm output 1+RS485com. output<br>Heating&Cooling: RS485com. output |
| | SP | 1 | Alarm output 1 |
| | S<br>M<br>W<br>H<br>L | 1 | Alarm output 1 |
| | | 2 | Alarm output 1+Alarm output 2 |
| | | R | Alarm output 1+Trans. output |
| | | T | Alarm output 1+RS485com. output |
| | | A | Alarm output 1+Alarm output 2+Trans. output |
| | | B | Alarm output 1+Alarm output 2+<br>RS485 com. output |
| | | D | Alarm output 1+Alarm output 2+Digital input(DI-1, DI-2)※6 |
| ⑤ Power Supply | 4 | | 100 to 240VAC, 50/60Hz |
| ⑥ OUT1 Control Output※2 | R | | Relay output |
| | S | | SSR drive output(standard ON/OFF, cycle, phase control) |
| | C | | Current output + SSR drive output |
| ⑦ OUT2 Control Output※3 | Standard | N | None<br>※Select in case of standard control (heating or cooling) |
| | Heating & Cooling | R | Relay output |
| | | C | Current output + SSR drive output |


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※1. In case of TK4N/SP Series, option control output selection and digital input will be limited due to number of terminals.

※2. “S” represents SSR drive output support models which SSRP function (standard ON/OFF, cycle, phase)control are available. “C” represents selectable current and SSR drive output support models.

※3. Select “R” or “C” type in case of using heating & cooling control. “N” type in case fo using standard control.

※4. The CT input model of TK4N is selectable only for standard model which has alarm 1.

※5. The Heaing & Cooling model of TK4N-1□□□ has only alarm output 2.

※6. Only for TK4S-D□□□, OUT2 output terminal is used as DI-2 input terminal.

※7. 11Pin socket(PG-11, PS-11): Sold separately

**Note**

CT (Current Transformer) input is supported by all models.

However, TK4SP (11 pin plug type) does not support CT input due to its limited number of terminal blocks.

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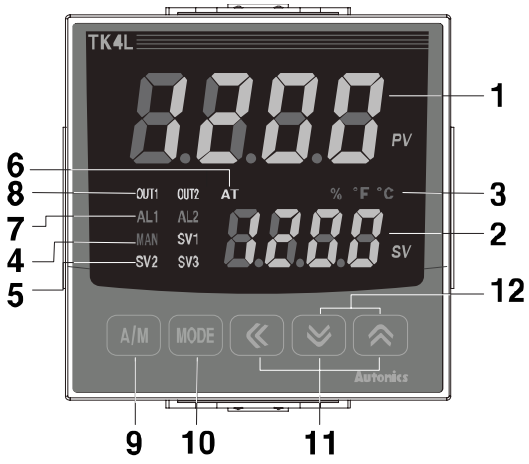
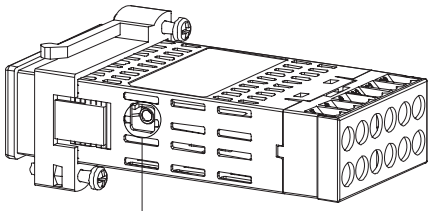
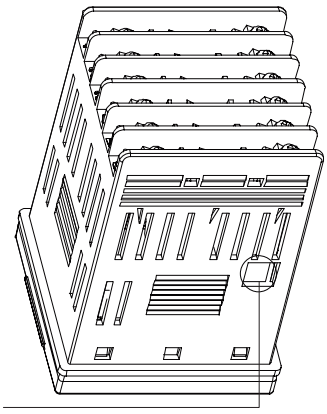
## 1.4 Parts descriptions



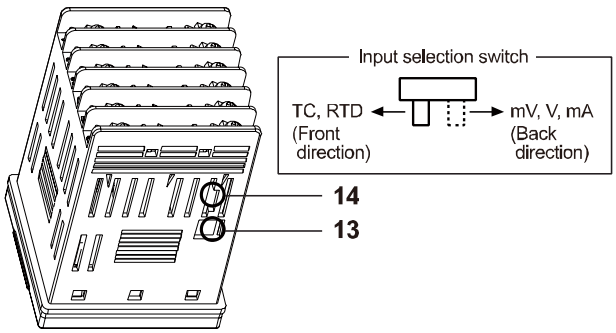

**TK4N Series**



**Other Series**




**The previous model**




① Measured value(PV) display part:
RUN mode: It displays currently measured value (PV).
Setting mode: It displays the parameter.

② Set value (SV) display part:
RUN mode: It displays the set value (SV).
Setting mode: It displays the set value of the parameter.

③ Unit(℃/℉/%) indicator: It displays the unit set at display unit [Unt] in parameter 3 group.
(TK4N Seires does not support '%' unit.)

④ Manual control indicator: It turns ON during manual controlling.

⑤ Multi SV indicator: One of SV1 to 3 indicator will be ON in case of selecting multi SV function.

⑥ Auto tuning indicator: It flashes by 1 sec. when executing auto tuning.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⑦ Alarm output (AL1, AL2) indicator: It turns ON when the alarm output is ON.

⑧ Control output (OUT1, OUT2) indicator: It turns ON when the control output is ON.
During cycle/phase controlling in SSRP function model (TK4□-□4S□)type, when MV is over 5.0%, it turns ON.
※ To use current ouput, when MV is 0.0% in manual control, it turns OFF. Otherwise, it always turns ON. When MV is over 3.0% in auto control, it turns ON and when MV is below 2.0%, it turns OFF.

⑨ A/M key: It is used when switching auto control to manual control.
※ TK4N/S/SP do not have the A/M key. The MODE key operates switching simultaneously.

⑩ MODE key: It is used when entering parameter group, returning to RUN mode, moving parameter, saving the set value.

⑪ ≪ ≫ ≫ key: It is used when entering the set value changing mode and moving or changing up/down digit.

⑫ Digital input key: When pressing the ≫ ≫ keys for 3 sec. at the same time, it operates the function (RUN/STOP, alarm clear,auto tuning) set at digital input key [dI -U] in parameter 5 group.

⑬ PC loader port: It is the PC loader port for serial communication to set parameter and monitoring by DAQMaster installed in PC. Use this for connecting SCM-US(USB to Serial converter, sold separately).

⑭ Input selection switch: Used when switching sensor (TC, RTD) input ↔ analog input(mV, V, mA) (only the previous models)

## Note

7-Segment Display Characters

| A | b | C | d | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | B | C | D | E | F | G | H | I | J | K | L | M |

| n | o | P | q | r | S | t | U | v | W | X | Y | Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | O | P | Q | R | S | T | U | V | W | X | Y | Z |

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | -1 | / |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | -1 | / |

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# 2 Specifications

| Series | | TK4N | TK4SP | TK4S | TK4M | TK4W | TK4H | TK4L |
|---|---|---|---|---|---|---|---|---|
| Power supply | | 100-240VAC, 50/60Hz | | | | | | |
| Allowable voltage range | | ±10% of rated voltage | | | | | | |
| Power consumption | | Max. 6VA | Max. 8VA | | | | | |
| Display method | | 7 segment (PV: red, SV: green), all other displays (green, orange, red) LED | | | | | | |
| Character size | PV(W×H) | 4.5 × 7.2 mm | 7.0×14.0mm | | 9.5×20.0 mm | 8.5×17.0 mm | 7.0×14.6 mm | 11.0×22.0 mm |
| | SV(W×H) | 3.5 × 5.8 mm | 5.0×10.0mm | | 7.5×15.0 mm | 6.0×12.0 mm | 6.0×12.0 mm | 7.0×14.0 mm |
| Input type | RTD | JPt 100Ω, DPt 100Ω, DPt 50Ω, Cu 100Ω, Cu 50Ω, and Nikel 120Ω (6 types) | | | | | | |
| | TC | K, J, E, T, L, N, U, R, S, B, C, G, and PLII (13 types) | | | | | | |
| | Analog | Voltage: 0-100mV, 0-5V, 1-5V, and 0-10V (4 types)<br>Current: 0-20mA and 4-20mA (2 types) | | | | | | |
| Display accuracy | RTD | At room temperature (23℃ ± 5℃): (PV ± 0.3% or ± 1℃, select the higher one) ± 1 digit※1<br>Out of room temperature ranges: (PV ± 0.5% or ± 2℃, select the higher one) ± 1 digit<br>In case of TK4SP Series, ±1℃ will be added. | | | | | | |
| | TC | | | | | | | |
| | Analog | At room temperature (23℃ ± 5℃): ± 0.3% F.S. ± 1 digit<br>Out of room temperature ranges: ± 0.5% F.S. ± 1 digit | | | | | | |
| | CT Input | ± 5% F.S. ± 1 digit | | | | | | |
| Control output | Relay | OUT1, OUT2: 250VAC 3A 1a | | | | | | |
| | SSR | Max.11VDC ± 2V 20mA | | | | | | |
| | Current | DC4-20mA or DC0-20mA selectable (resistance load max. 500Ω) | | | | | | |
| Alarm output | Relay | AL1, AL2 Relay: 250VAC 3A 1a<br>(TK4N AL2: 250VAC 0.5A 1a (max. 125VA), TK4SP has only AL1) | | | | | | |
| Option output | Transmission output | DC4-20mA (resistance load max. 500Ω, output accuracy: ±0.3% F.S) | | | | | | |
| | Comm. | RS485 Communication Output (Modbus RTU) | | | | | | |
| Option input | CT | 0.0-50.0A (primary heater current reading range) ※CT Ratio is 1/1000 (except TK4SP) | | | | | | |
| | Digital input | Contact input - ON: Max. 2kΩ, OFF: Min. 90kΩ<br>Non-Contact input - ON: Residual voltage max. 1.0V, OFF: Leakage current min. 0.1mA<br>Leakage current: Approx. 0.5mA per input<br>※TK4S/M-1EA(TK4S-D□□□-2EA, TK4SP-None), TK4N/H/W/L-2EA(except TK4SP) | | | | | | |
| Control type | Heating & cooling | ON/OFF, P, PI, PD, PID control mode | | | | | | |
| | Heating or Cooling | | | | | | | |
| Hysteresis | | RTD/ Thermocouples: 1 to 100℃/℉ (0.1 to 100.0℃/℉) variable<br>Analog: 1 to 100 digit | | | | | | |
| Proportional band (P) | | 0.1 to 999.9℃/℉ (0.1 to 999.9%) | | | | | | |
| Integral time (I) | | 0 to 9999sec. | | | | | | |
| Derivative time (D) | | 0 to 9999sec. | | | | | | |

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| | | | | | | |
|---|---|---|---|---|---|---|
| Control period (T) | | Relay output, SSR drive output: 0.1 to 120.0 sec.<br>Current output+SSR drive output: 1.0 to 120.0 sec. | | | | |
| Manual reset value | | 0.0 to 100.0% | | | | |
| Sampling period | | 50 ms | | | | |
| Dielectric strength | | 2,000 VAC 50/60 Hz for 1 min. (between power source terminal and input terminal) | | | | |
| Vibration resistance | | 0.75mm amplitude at frequency of 5 to 55 Hz (for 1 min.) in each of X, Y, Z directions for 2 hours | | | | |
| Relay life cycle | Mechanical | OUT1/OUT2: Min. 5,000,000 operations<br>AL1/2: Min. 20,000,000 operations (TK4H/W/L: Min. 5,000,000 operations) | | | | |
| | Electrical | OUT1/OUT2: Min. 200,000 operations<br>AL1/2: Min. 100,000 operations(TK4H/W/L: Min. 200,000 operations) | | | | |
| Insulation resistance | | Min. 100MΩ (at 500VDC megger) | | | | |
| Noise resistance | | Square shaped noise by noise simulator (pulse width 1 μs) ±2 kV R-phase, S-phase | | | | |
| Memory retention | | Approx. 10 years (non-volatile semiconductor memory type) | | | | |
| Environ -ment | Ambient temp. | -10 to 50℃, Storage: -20 to 60℃ | | | | |
| | Ambient humi. | 35 to 85% RH, Storage: 35 to 85% RH | | | | |
| Protection | | IP65 (front panel) ※TK4SP: IP50 (front panel) | | | | |
| Insulation type | | Double insulation or reinforced insulation<br>(mark: ⊡, dielectric strength between the measuring input part and the power part: 2kV) | | | | |
| Approval | | CE cULus | | | | |
| Weight※2 | | Approx. 140 g (Approx. 70 g) | Approx. 130 g (Approx. 85 g) | Approx. 150 g (Approx. 105 g) | Approx. 210 g (Approx. 140 g) | Approx. 211 g (Approx. 141 g) | Approx. 249 g (Approx. 198 g) |

※1. At room Temperature range(23℃ ± 5℃)

- TC K, J, T, N, E type , below -100℃ / TC L, U, PLⅡ, RTD Cu50Ω, DPt50Ω: (PV ±0.3% or ±2℃, select the higher one) ± 1digit
- TC C, G, R, S type bellow 200℃: (PV ±0.3% or ±3℃, select the higher one) ± 1 digit
- TC B type, below 400℃: There is no accuracy standard.

Out of room temperature range

- RTD Cu50Ω, DPt50Ω: (PV ±0.5% or ±3℃, select the higher one) ±1digit
- TC R, S, B, C, G type: (PV ±0.5% or ±5℃, select the higher one) ±1digit
- Others, Below -100℃, Within ±5℃

In case of TK4SP Series, ±1℃ will be added to the degree standard.

※2: The weight is with packaging and the weight in parentheses is only unit weight.

※Environment resistance is rated at no freezing or condensation.


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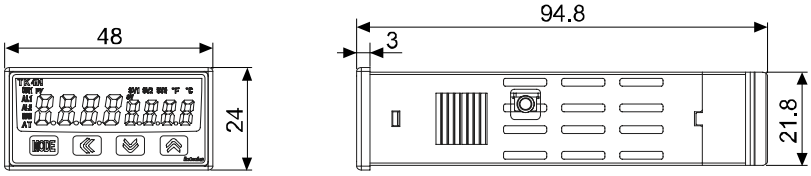
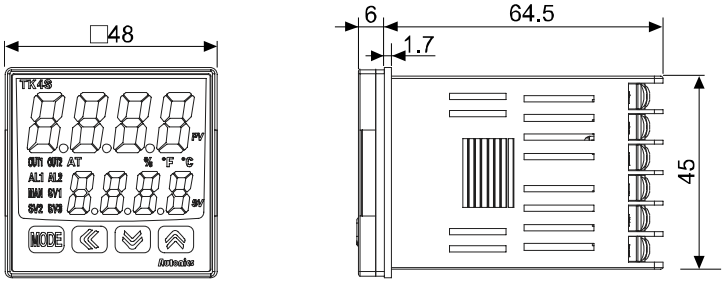
# 3 Dimensions

(unit: mm)

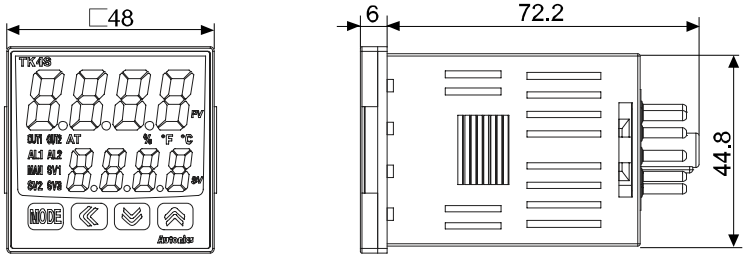
### (1) TK4N Series



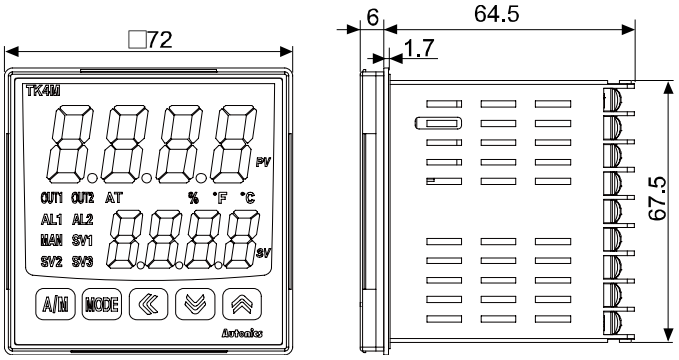

### (2) TK4S Series




### (3) TK4SP Series




### (4) TK4M Series

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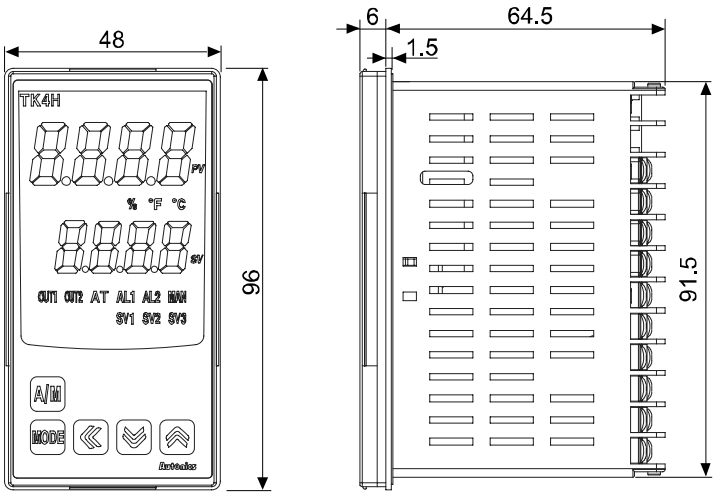
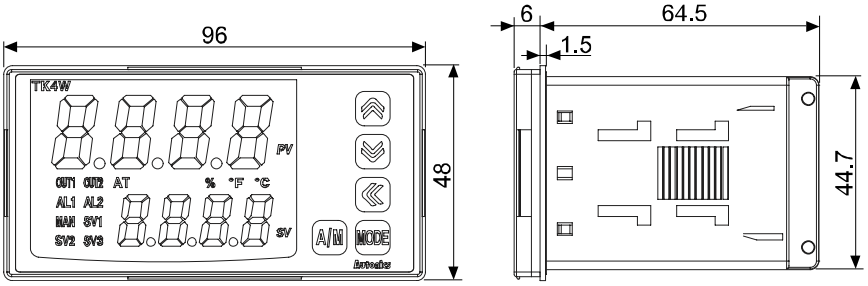
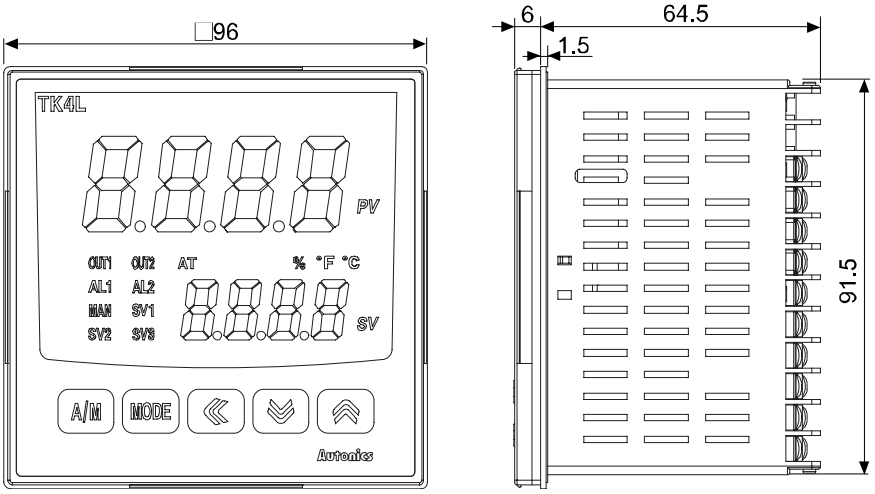
### (5) TK4H Series




### (6) TK4W Series




### (7) TK4L Series





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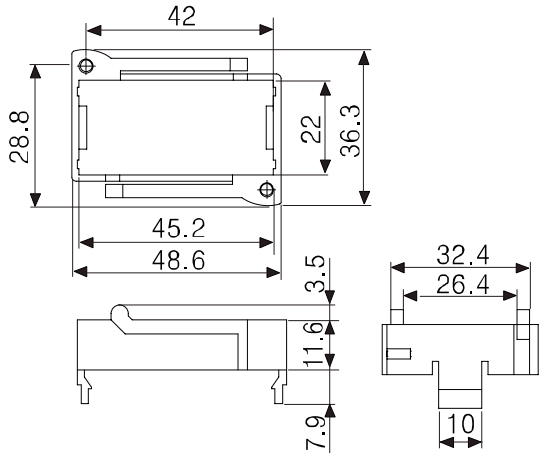
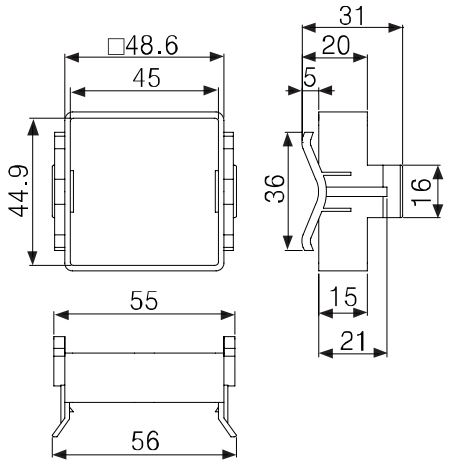
### (8) Bracket

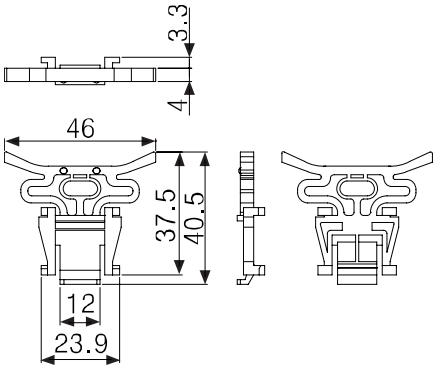
- TK4N Series




- TK4S, TK4SP Series




- TK4M/W/H/L Series

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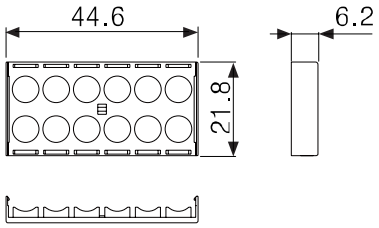
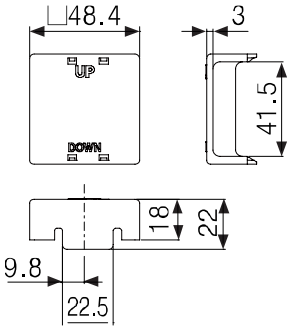
### (9) Terminal cover(sold separately)

- TK4N COVER(48×24mm)

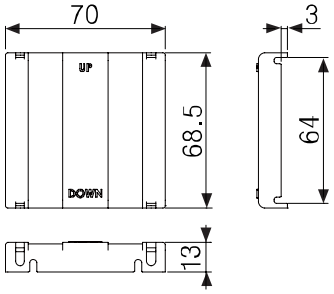



※TK4N COVER is provided.

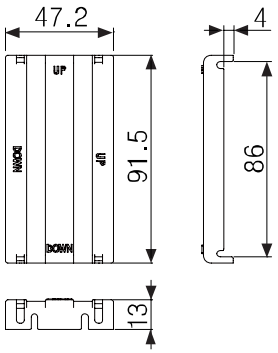
- RSA-COVER(48×48mm)




- RMA-COVER(72×72mm)




- RHA-COVER(48×96mm, 96×48mm)





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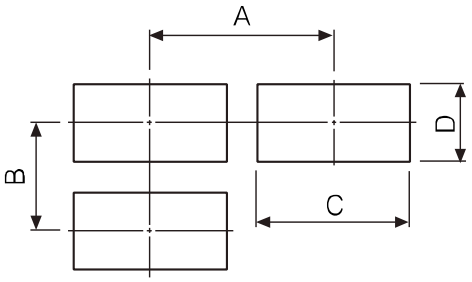
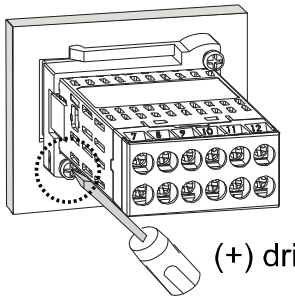
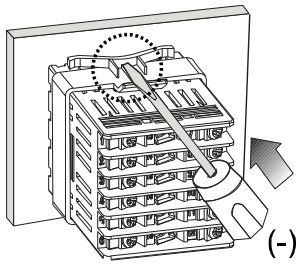
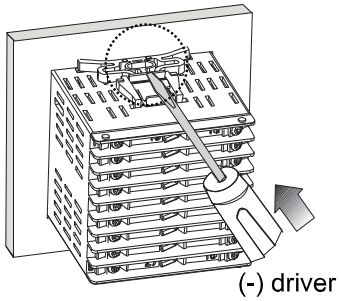
### (10) Panel cut-out




(unit: mm)

| Model \ Size | A | B | C | D |
|---|---|---|---|---|
| TK4N | Min. 55 | Min. 37 | $45^{+0.6}_{0}$ | $22.2^{+0.3}_{0}$ |
| TK4S | Min. 65 | Min. 65 | $45^{+0.6}_{0}$ | $45^{+0.6}_{0}$ |
| TK4SP | Min. 65 | Min. 65 | $45^{+0.6}_{0}$ | $45^{+0.6}_{0}$ |
| TK4M | Min. 90 | Min. 90 | $68^{+0.7}_{0}$ | $68^{+0.7}_{0}$ |
| TK4H | Min. 65 | Min. 115 | $45^{+0.6}_{0}$ | $92^{+0.8}_{0}$ |
| TK4W | Min. 115 | Min. 65 | $92^{+0.8}_{0}$ | $45^{+0.6}_{0}$ |
| TK4L | Min. 115 | Min. 115 | $92^{+0.8}_{0}$ | $92^{+0.8}_{0}$ |

- Installation

| TK4N | TK4S/SP | Other Series |
|---|---|---|
|   |   |   |
| Insert the unit into a panel fasten the bolt with a (+) driver. | Insert the unit into a panel fasten the bracket by pushing with tools with a (-) driver. | |

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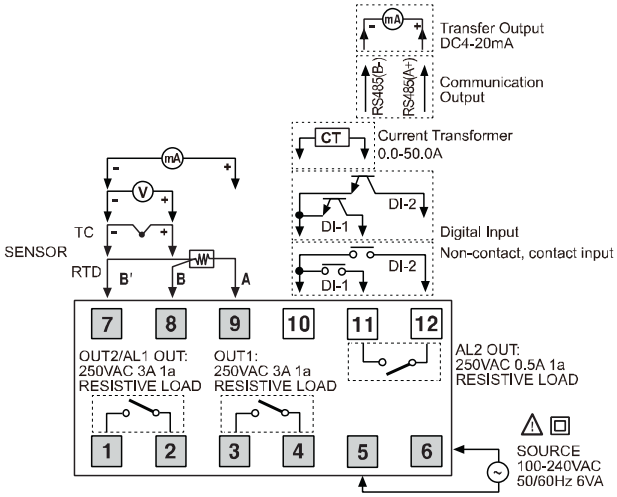
# 4 Connections

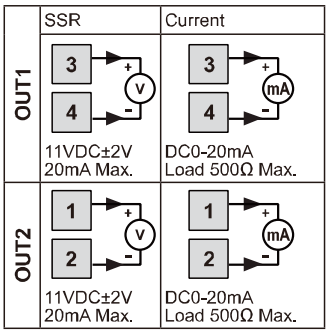
Be sure that the polarity for input connectiong a temperature sensor or analog input.
Standard model has shaded terminals only.

When the operation mode of heating&cooling OUT2 relay output model is heating or cooling control, the OUT2 is usable as alarm output 3(except TK4N).

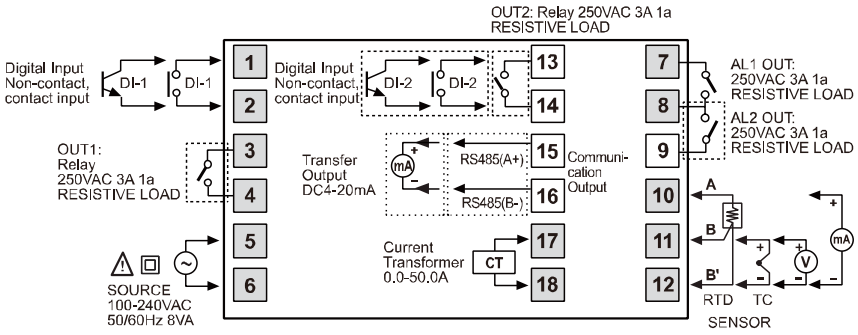
When the operation mode of heating & cooling OUT2 current model is heating or cooling control, the OUT2 is usable as transmisstion output 2.

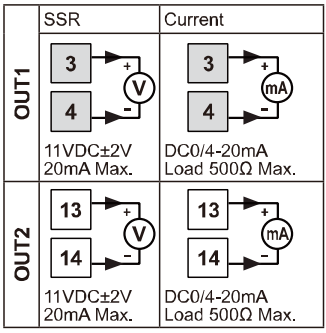
### (1) TK4N Series




### (2) TK4S Series




**Note**

Features one digital input terminal (DI-1) due to limited number of terminal blocks. Supports two multi SVs (SV1 and SV2) only.

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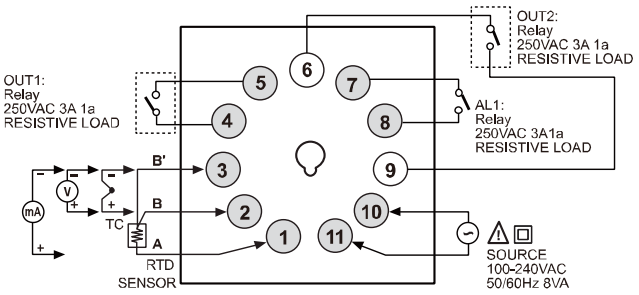
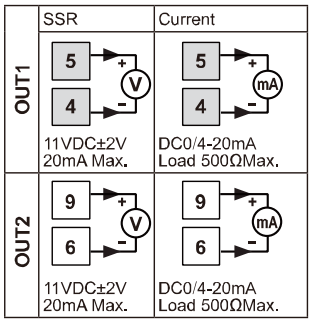
### (3) TK4SP Series

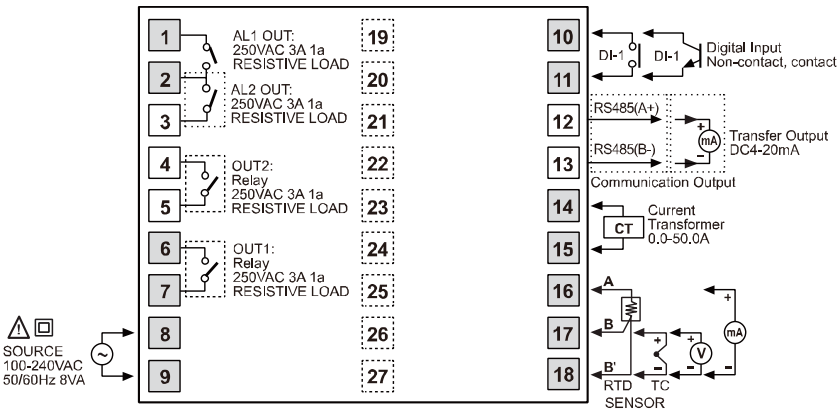


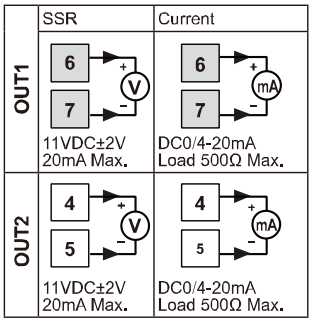




**Note**

Does not feature any digital input terminal due to limited number of terminal blocks.
11Pin Socket(PG-11, PS-11): Sold separately

### (4) TK4M Series

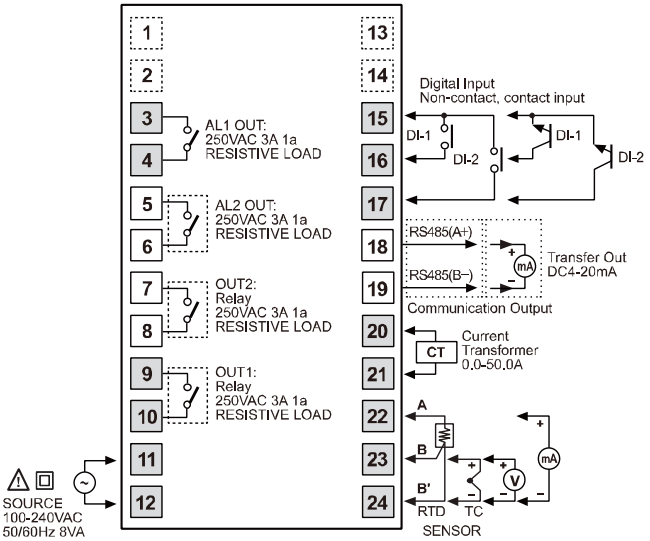


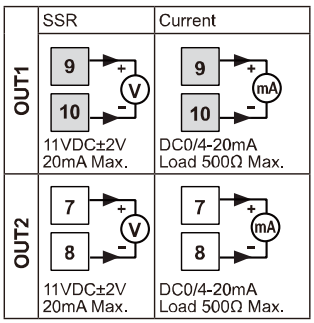




**Note**

Features one digital input terminal (DI-1) due to limited number of terminal blocks. Supports two multi SVs (SV1 and SV2) only.

### (5) TK4W, TK4H, TK4L Series




※ Digital input is not electrically insulated from internal circuits, so it sholud be insulated when connecting other circuits. (photocoupler, relay, independent switch)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## 4.1 Precautions for wiring

- Mixing up the input terminals with output terminals and vice versa can lead to product damage.
- Use only sensors supported by the product.
- Make sure to connect rated SSRs or loads to the output terminals. Make sure to connect communication cable with correct communication terminals (A, B).
- Make sure to observe correct polarity of power source terminals. (+ and -).
- Make sure to connect correct polarity of temperature sensor and analog input.

### 4.1.1 Sensor connection

- Compensation Wire Connection

  For thermocouple sensors, use compensation wire of the same specification as input sensors. Using an extension wire of different specifications and/or material will increase inaccuracy of temperature sensing. It is recommended to choose high performance compensation wire for more reliable sensing.

- Measurement Error

  Do not mix up the direction of the input sensor connector.

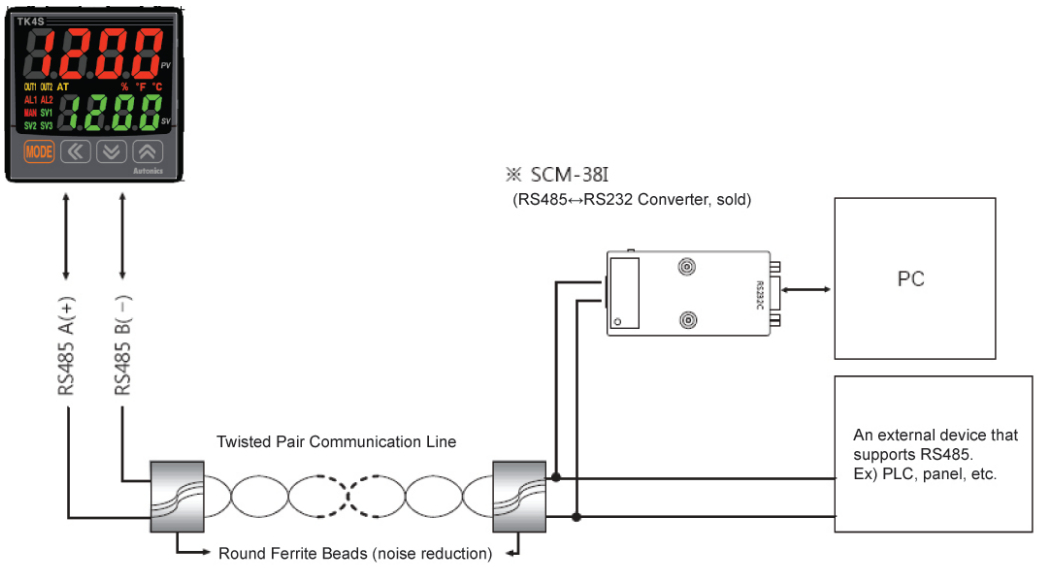
  Carefully adjust both load and sensor positions.

  Make sure the sensor is securely attached to the input connector.

- AC Power Cable and Wiring

  Do not put the sensor lines in close proximity of the AC power lines.

### 4.1.2 Communication connection




**Note**

Do not tie together with the AC power line and communication line. Only use twisted pair wires for the communication lines. Do not allow the communication line to exceed 800m in length.

For further details, please refer to ‘6.6 Communication ’.

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# 5 Preparation and Startup

## 5.1 Initial display when power ON

When power is supplied, whole display parts flash for 1 sec. Afterwards, model name and input sensor type will be flash twice and then in enters into RUN mode.

| ①Whole display part | ②Model type display | ③Input type display twice | ④RUN mode |
|---|---|---|---|
| | | | |

| SV display part | | Display type | Type | |
|---|---|---|---|---|
| 1, 2, d, r, t | TK4N | Option Input/ Output | 1 | Standard: Alarm output1+CT input<br>Heating & Cooling: Alarm output2 |
| | | | 2 | Standard: Alarm output1+Alarm output2 |
| | | | d | Standard: Alarm output1+Digital input(DI-1, DI-2)<br>Heating & Cooling: Digital input (DI-1, DI-2) |
| | | | r | Standard: Alarm output1+Trans. output<br>Heating & Cooling: Trans. output |
| | | | t | Standard: Alarm output1+RS485 com. output<br>Heating & Cooling: RS485 comm. output |
| 1, 2, r, t, A, b, d | TK4S/SP/ M/W/H/L | | 1 | Alarm output1 |
| | | | 2 | Alarm output1+Alarm output2 |
| | | | r | Alarm output1+ Trans. output |
| | | | t | Alarm output1+RS485 com. output |
| | | | A | Alarm output1/2+ Trans. output |
| | | | b | Alarm output1/2+RS485 com. output |
| | | | d | Alarm output1/2+ Digital input(DI-1, DI-2) |
| 4 | | Power supply | 100-240VAC 50/60Hz | |
| r, S, C | | OUT1 control output | r | Relay contact |
| | | | S | SSR drive output<br>(standard ON/OFF, cycle, phase control) |
| | | | C | Current + SSR drive output |
| n, r, C | | OUT2 control output | n | None |
| | | | r | Relay contact |
| | | | C | Current + SSR drive output |

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# 5.2 Basic controls

## 5.2.1 Parameter setting sequence

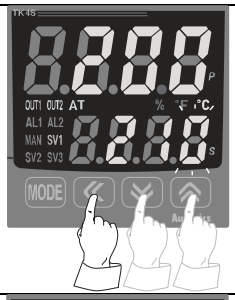
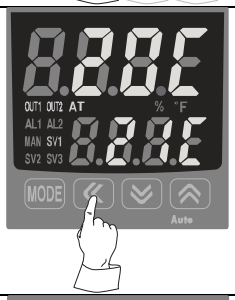
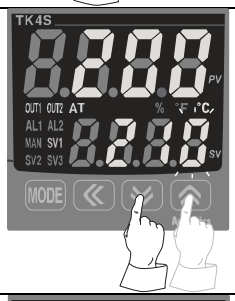
Parameters of each group are connected each other. Therefore, follow the below parameter order.

Parameter 3 Group [PAr 3] → Parameter 4 Group [PAr 4] → Parameter 5 Group [PAr 5] →
Parameter 2 Group [PAr 2] → Parameter 1 Group [PAr 1] → SV Setting [SV]

**Note**

Changing Parameter 3 Group's parameters can sometimes reset other associated parameters. Always make sure to check if such parameters have been affected.

## 5.2.2 Set value (SV) setting

| | | |
|---|---|---|
| ① |  | Press any key among ≪, ≫, ≫ in RUN mode to enter SV setting mode. Last digit ($10^0$ digit) on SV display part flashes. |
| ② |  | Press the ≪ key to move digit.<br>($10^0$ → $10^1$ → $10^2$ → $10^3$ → $10^0$) |
| ③ |  | Press the ≫, ≫ keys to raise or lower the set value. |
| ④ | | Press the MODE key to save the set value. If there is no additional key operations in 3 sec., the changed SV is automatically saved. |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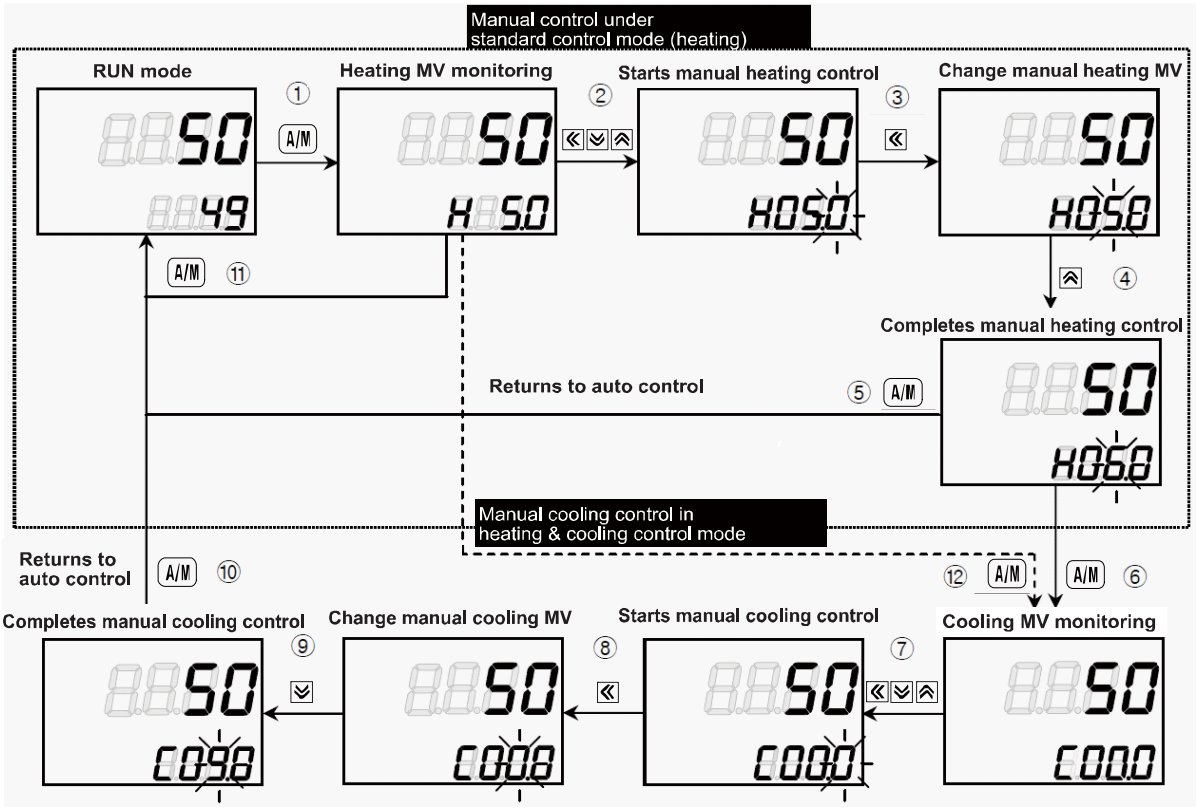
## 5.2.3 MV monitoring and manual control


Manual control under standard control mode (heating)
RUN mode
Heating MV monitoring
Starts manual heating control
Change manual heating MV
Completes manual heating control
Returns to auto control
Manual cooling control in heating & cooling control mode
Returns to auto control
Completes manual cooling control
Change manual cooling MV
Starts manual cooling control
Cooling MV monitoring
A/M

① While in RUN mode, press the A/M key to commence manual control. The SV display will then show H (heating control) or C (cooling control) and simultaneously display the MV to indicate commencement of MV monitoring.

② If the ≪, ≫ , or ≫ is pressed while MV monitoring is in progress, the MAN indicator will turn on and the last digit will start to flash to indicate activation of manual control.

③ Press the ≪ key to change the flashing digit ($10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0$).

④ Select the digit and configure the desired MV value using the ≫, ≫ keys.

⑤ To end manual control, press the A/M key. The MAN indicator will turn off, and the system will revert to auto control mode.

⑥ While in heating & cooling control mode, set the manual heating MV and then press the A/M key to see C (cooling control) and the current cooling MV value on the SV display indicating commencement of cooling MV monitoring.

⑦ If the ≪, ≫ , or ≫ is pressed while MV monitoring is in progress, the MAN indicator turns on and the last digit starts to flash to indicate activation of manual control.

⑧ Press the ≪ key to change the flashing digit ($10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0$).

⑨ Select the digit and configure desired cooling MV value using the ≫, ≫ keys.

⑩ To end manual control, press the A/M key. The MAN indicator will turn off, and the system will revert to auto control mode.

⑪ While in standard control mode (heating control or cooling control), pressing the A/M key once from the MV monitoring stage, or any other stage, will revert the system to auto control mode.

⑫ During heating & cooling control mode, pressing the A/M key once from the MV monitoring stage, or any other stage, will skip the system to the cooling MV monitoring stage.

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## Note

For heating & cooling control, the system reverts to auto control after going through heating monitoring, manual heating control, cooling monitoring, and manual cooling control stages in sequence.

Heating MV remains in effect during cooling monitoring and manual cooling control.

When setting ditial input function as AUTO/MANUAL, MV monitoring and control status

| Control status | MV | Monitoring |
|---|---|---|
| AUTO | Not changed | Avaliable |
| MANUAL | Changeable | |

TK4N/S/SP model's the MODE key alternates the A/M key.


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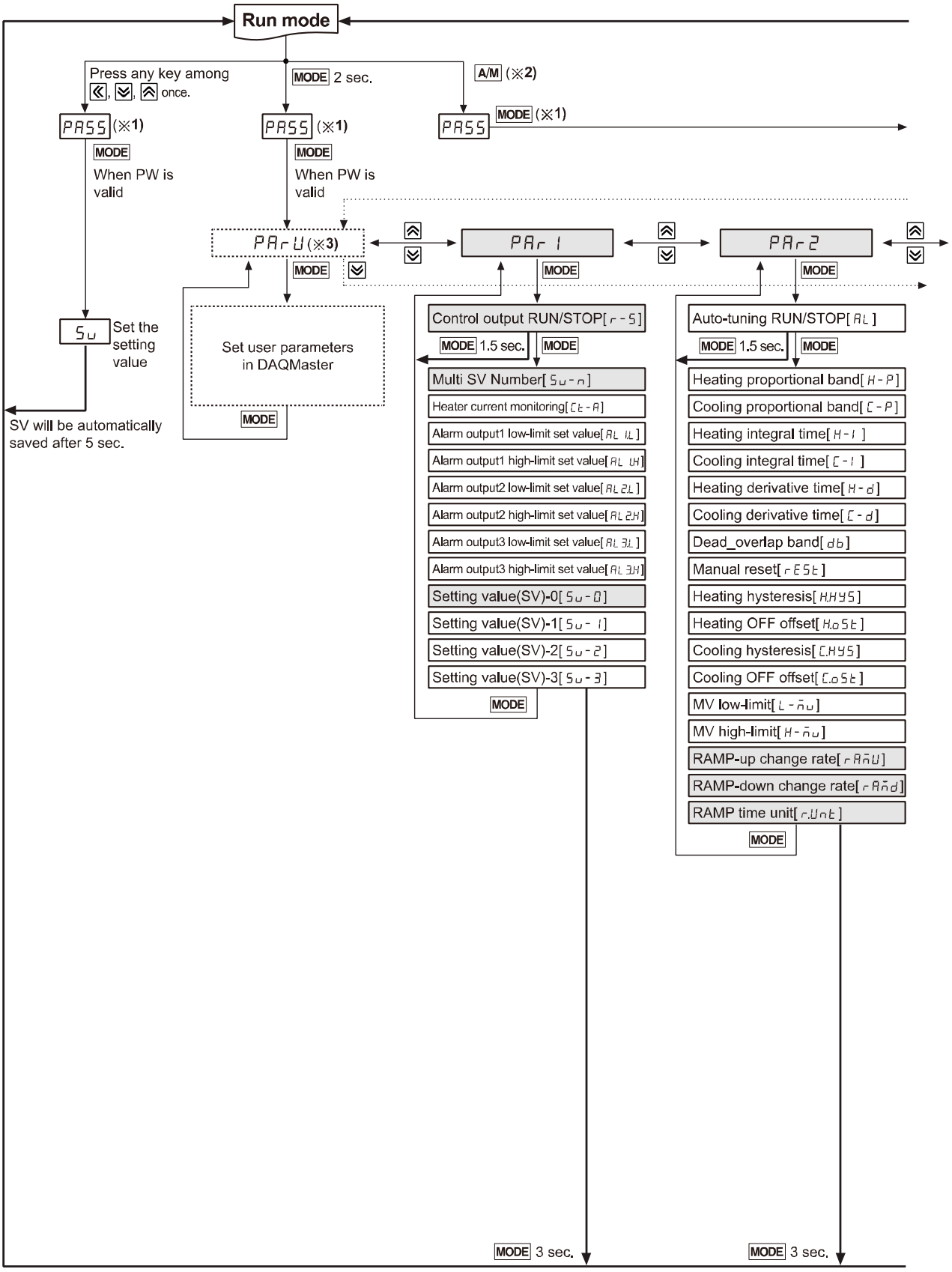
# 5.3 Parameter group





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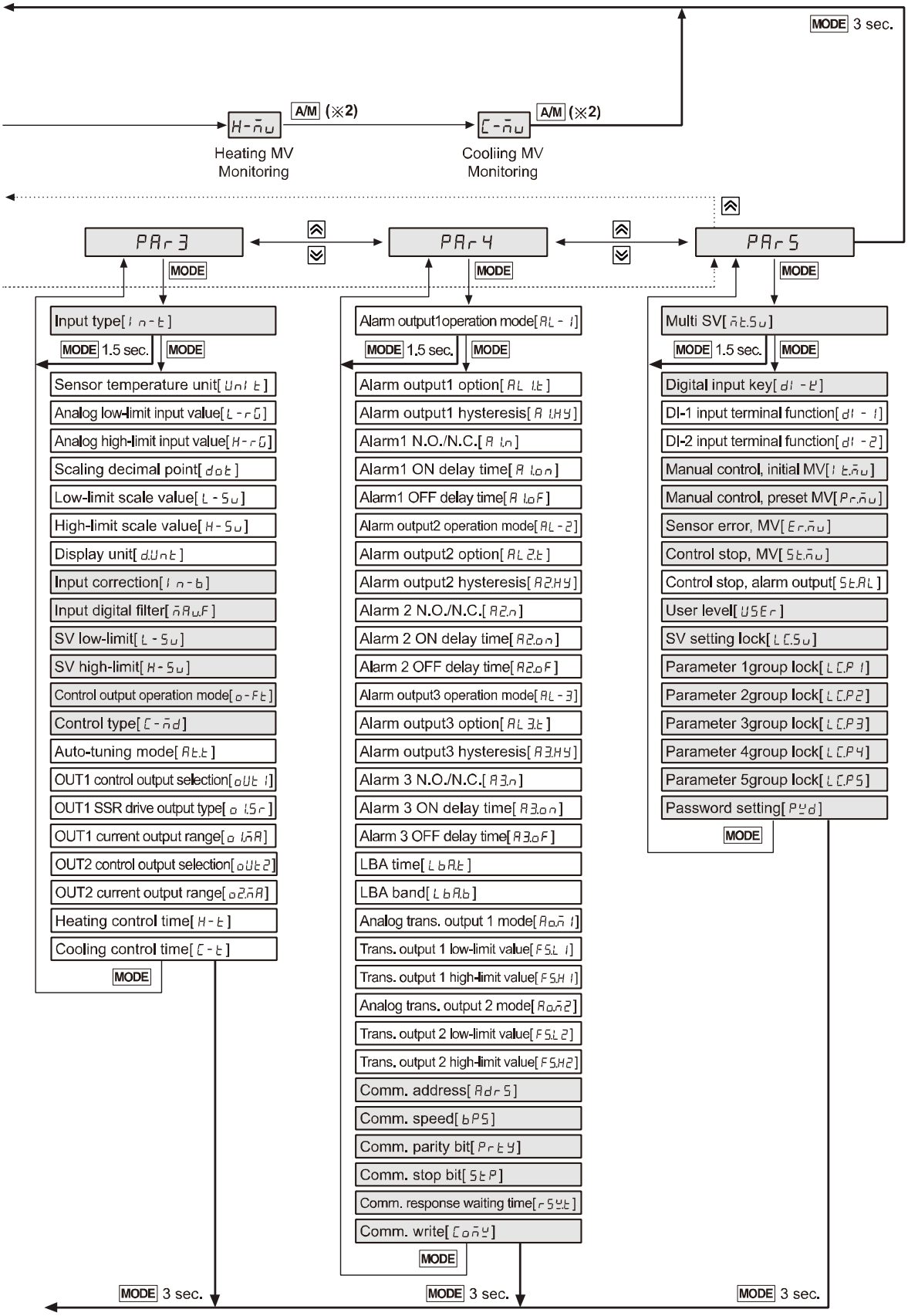
MODE 3 sec.
H-mV
A/M (※2)
C-mV
A/M (※2)
Heating MV Monitoring
Cooliing MV Monitoring
PAr3
PAr4
PAr5
MODE
Input type[in-t]
MODE 1.5 sec.
MODE
Sensor temperature unit[Unit t]
Analog low-limit input value[L-rG]
Analog high-limit input value[H-rG]
Scaling decimal point[dot]
Low-limit scale value[L-Su]
High-limit scale value[H-Su]
Display unit[dUnt]
Input correction[in-b]
Input digital filter[mAuF]
SV low-limit[L-Su]
SV high-limit[H-Su]
Control output operation mode[o-Ft]
Control type[C-md]
Auto-tuning mode[Att]
OUT1 control output selection[oUt1]
OUT1 SSR drive output type[o1Sr]
OUT1 current output range[o1mA]
OUT2 control output selection[oUt2]
OUT2 current output range[o2mA]
Heating control time[H-t]
Cooling control time[C-t]
MODE
Alarm output1operation mode[AL-1]
MODE 1.5 sec.
MODE
Alarm output1 option[AL 1t]
Alarm output1 hysteresis[A1HY]
Alarm1 N.O./N.C.[A1n]
Alarm1 ON delay time[A1on]
Alarm1 OFF delay time[A1oF]
Alarm output2 operation mode[AL-2]
Alarm output2 option[AL 2t]
Alarm output2 hysteresis[A2HY]
Alarm 2 N.O./N.C.[A2n]
Alarm 2 ON delay time[A2on]
Alarm 2 OFF delay time[A2oF]
Alarm output3 operation mode[AL-3]
Alarm output3 option[AL 3t]
Alarm output3 hysteresis[A3HY]
Alarm 3 N.O./N.C.[A3n]
Alarm 3 ON delay time[A3on]
Alarm 3 OFF delay time[A3oF]
LBA time[LbAt]
LBA band[LbAb]
Analog trans. output 1 mode[Aom1]
Trans. output 1 low-limit value[FSL1]
Trans. output 1 high-limit value[FSH1]
Analog trans. output 2 mode[Aom2]
Trans. output 2 low-limit value[FSL2]
Trans. output 2 high-limit value[FSH2]
Comm. address[Adr S]
Comm. speed[bPS]
Comm. parity bit[PrtY]
Comm. stop bit[StP]
Comm. response waiting time[rSdt]
Comm. write[Comm]
MODE
Multi SV[mt.Su]
MODE 1.5 sec.
MODE
Digital input key[di-K]
DI-1 input terminal function[di-1]
DI-2 input terminal function[di-2]
Manual control, initial MV[1st.mV]
Manual control, preset MV[Pr.mV]
Sensor error, MV[Er.mV]
Control stop, MV[St.mV]
Control stop, alarm output[StAL]
User level[USEr]
SV setting lock[LC.Su]
Parameter 1group lock[LC.P1]
Parameter 2group lock[LC.P2]
Parameter 3group lock[LC.P3]
Parameter 4group lock[LC.P4]
Parameter 5group lock[LC.P5]
Password setting[PWd]
MODE
MODE 3 sec.
MODE 3 sec.
MODE 3 sec.

※1. PASS parameter will be displayed only when password is set. It is not displayed when purchasing the unit since default password is set to 0000.
If password is not valid, the screen will be shifted to password code required window. Press any key among ◁ ▽ △ to return to password entering window. Press MODE key to return to RUN mode.
In case you forget password, contact Autonics A/S center after checking password code.

※2. TK4N/4S/4SP do not have A/M key. The MODE key replaces A/M key.

※3. It is displayed when setting user parameter group in the integrated device management program (DAQMaster).

**Note**

- Press MODE key over 2 sec in RUN mode to enter into setting mode.
- Press MODE key for 1.5 sec while in setting mode to move to other parameter group.
- Press MODE key over 3 sec while in setting mode to return to RUN mode.
- Press MODE key at the last parameter of each parameter, it moves to that parameter name. You can move to other groups.
- If there is no additional key operation within 30 sec after entering into setting mode, it will be automatically returned to RUN mode and previous setting value will be remained
- The shaded parameters are displayed in common.
  The others may not be displayed by the specifications of the product, other parameter's setting, or parameter mask setting.


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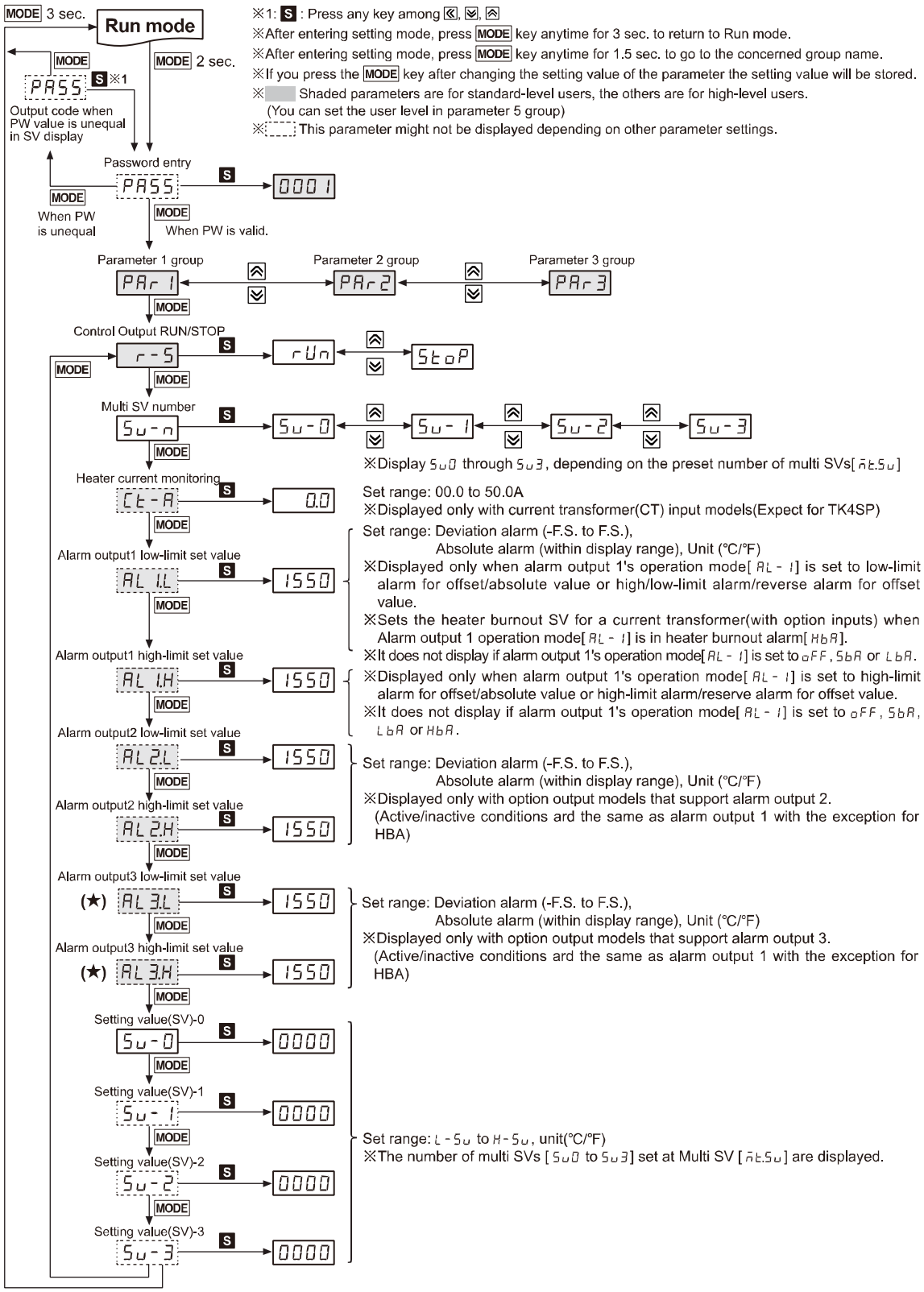
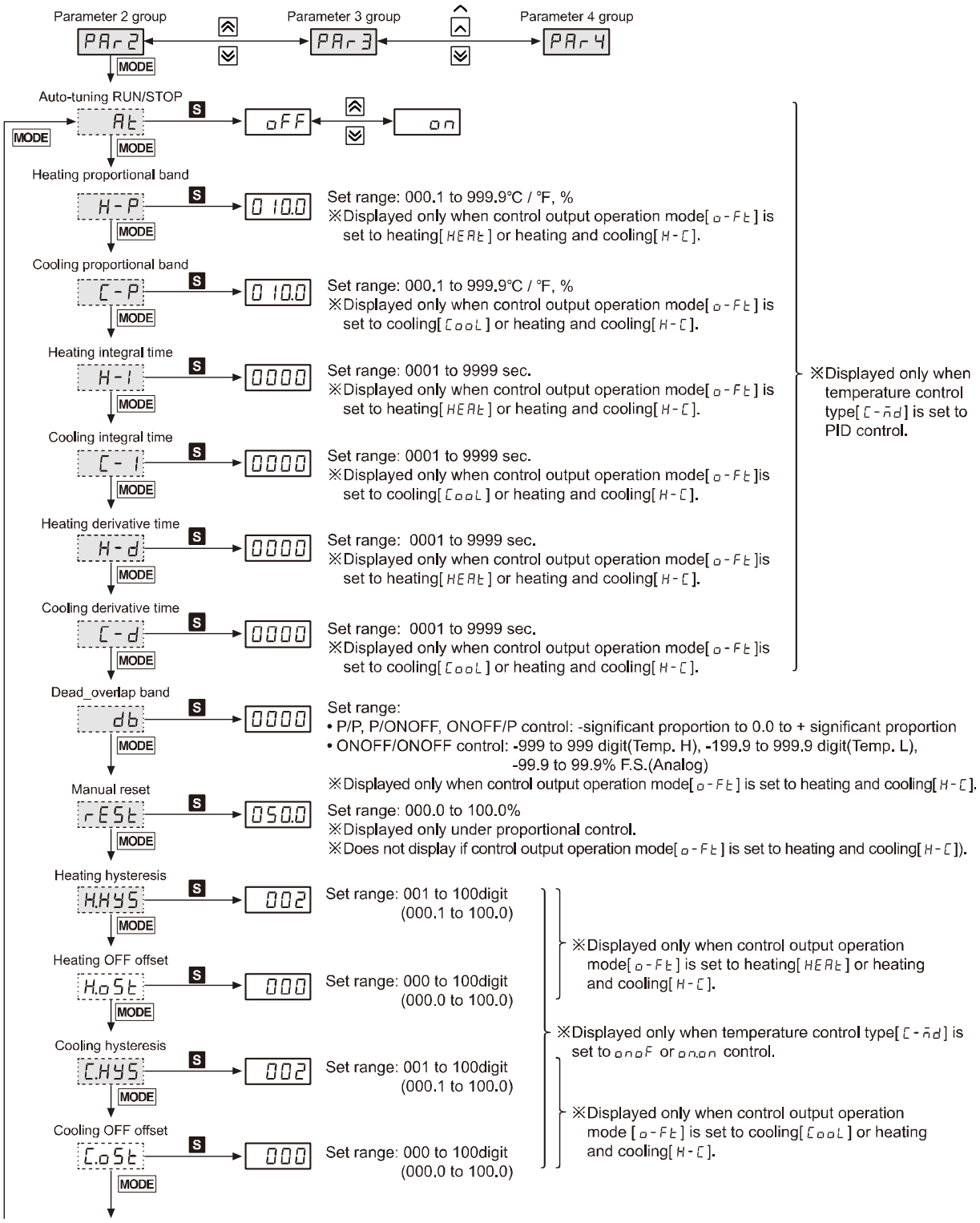
# 5.4 Parameter groups

## 5.4.1 Parameter 1 group [PAr 1]


※1: S : Press any key among ◁, ▽, △
※After entering setting mode, press MODE key anytime for 3 sec. to return to Run mode.
※After entering setting mode, press MODE key anytime for 1.5 sec. to go to the concerned group name.
※If you press the MODE key after changing the setting value of the parameter the setting value will be stored.
※ Shaded parameters are for standard-level users, the others are for high-level users.
(You can set the user level in parameter 5 group)
※ This parameter might not be displayed depending on other parameter settings.
MODE 3 sec.
Run mode
MODE
MODE 2 sec.
PASS S ※1
Output code when PW value is unequal in SV display
Password entry
PASS
0001
When PW is unequal
When PW is valid.
Parameter 1 group
Parameter 2 group
Parameter 3 group
PAr 1
PAr 2
PAr 3
Control Output RUN/STOP
r-S
rUn
StoP
Multi SV number
Su-n
Su-0
Su-1
Su-2
Su-3
※Display Su0 through Su3, depending on the preset number of multi SVs[ntSu]
Heater current monitoring
CT-A
0.0
Set range: 00.0 to 50.0A
※Displayed only with current transformer(CT) input models(Expect for TK4SP)
Alarm output1 low-limit set value
AL 1L
1550
Set range: Deviation alarm (-F.S. to F.S.),
Absolute alarm (within display range), Unit (℃/℉)
※Displayed only when alarm output 1's operation mode[AL-1] is set to low-limit alarm for offset/absolute value or high/low-limit alarm/reverse alarm for offset value.
※Sets the heater burnout SV for a current transformer(with option inputs) when Alarm output 1 operation mode[AL-1] is in heater burnout alarm[HbA].
※It does not display if alarm output 1's operation mode[AL-1] is set to oFF, SbA or LbA.
Alarm output1 high-limit set value
AL 1H
1550
※Displayed only when alarm output 1's operation mode[AL-1] is set to high-limit alarm for offset/absolute value or high-limit alarm/reserve alarm for offset value.
※It does not display if alarm output 1's operation mode[AL-1] is set to oFF, SbA, LbA or HbA.
Alarm output2 low-limit set value
AL 2L
1550
Set range: Deviation alarm (-F.S. to F.S.),
Absolute alarm (within display range), Unit (℃/℉)
※Displayed only with option output models that support alarm output 2.
(Active/inactive conditions ard the same as alarm output 1 with the exception for HBA)
Alarm output2 high-limit set value
AL 2H
1550
Alarm output3 low-limit set value
(★) AL 3L
1550
Set range: Deviation alarm (-F.S. to F.S.),
Absolute alarm (within display range), Unit (℃/℉)
※Displayed only with option output models that support alarm output 3.
(Active/inactive conditions ard the same as alarm output 1 with the exception for HBA)
Alarm output3 high-limit set value
(★) AL 3H
1550
Setting value(SV)-0
Su-0
0000
Setting value(SV)-1
Su-1
0000
Setting value(SV)-2
Su-2
0000
Setting value(SV)-3
Su-3
0000
Set range: L-Su to H-Su, unit(℃/℉)
※The number of multi SVs [Su0 to Su3] set at Multi SV [ntSu] are displayed.

## 5.4.2 Parameter 2 group [PAr2]

※1: S : Press any key among ≪, ≫, ≪
※After entering setting mode, press MODE key anytime for 3 sec. to return to Run mode.
※After entering setting mode, press MODE key anytime for 1.5 sec. to go to the concerned group name.
※If you press the MODE key after changing the setting value of the parameter the setting value will be stored.
※ Shaded parameters are for standard-level users, the others are for high-level users.
(You can set the user level in parameter 5 group)
※ This parameter might not be displayed depending on other parameter settings.


Parameter 2 group
PAr2
Parameter 3 group
PAr3
Parameter 4 group
PAr4
MODE
Auto-tuning RUN/STOP
AT
S
oFF
on
Heating proportional band
H-P
0 10.0
Set range: 000.1 to 999.9℃ / ℉, %
※Displayed only when control output operation mode[ o-Ft ] is set to heating[ HEAt ] or heating and cooling[ H-C ].
Cooling proportional band
C-P
0 10.0
Set range: 000.1 to 999.9℃ / ℉, %
※Displayed only when control output operation mode[ o-Ft ] is set to cooling[ CooL ] or heating and cooling[ H-C ].
Heating integral time
H-I
0000
Set range: 0001 to 9999 sec.
※Displayed only when control output operation mode[ o-Ft ] is set to heating[ HEAt ] or heating and cooling[ H-C ].
Cooling integral time
C-I
0000
Set range: 0001 to 9999 sec.
※Displayed only when control output operation mode[ o-Ft ]is set to cooling[ CooL ] or heating and cooling[ H-C ].
Heating derivative time
H-d
0000
Set range: 0001 to 9999 sec.
※Displayed only when control output operation mode[ o-Ft ]is set to heating[ HEAt ] or heating and cooling[ H-C ].
Cooling derivative time
C-d
0000
Set range: 0001 to 9999 sec.
※Displayed only when control output operation mode[ o-Ft ]is set to cooling[ CooL ] or heating and cooling[ H-C ].
※Displayed only when temperature control type[ C-nd ] is set to PID control.
Dead_overlap band
db
0000
Set range:
• P/P, P/ONOFF, ONOFF/P control: -significant proportion to 0.0 to + significant proportion
• ONOFF/ONOFF control: -999 to 999 digit(Temp. H), -199.9 to 999.9 digit(Temp. L),
-99.9 to 99.9% F.S.(Analog)
※Displayed only when control output operation mode[ o-Ft ] is set to heating and cooling[ H-C ].
Manual reset
rESt
050.0
Set range: 000.0 to 100.0%
※Displayed only under proportional control.
※Does not display if control output operation mode[ o-Ft ] is set to heating and cooling[ H-C ]).
Heating hysteresis
H.HYS
002
Set range: 001 to 100digit
(000.1 to 100.0)
Heating OFF offset
H.oSt
000
Set range: 000 to 100digit
(000.0 to 100.0)
※Displayed only when control output operation mode[ o-Ft ] is set to heating[ HEAt ] or heating and cooling[ H-C ].
Cooling hysteresis
C.HYS
002
Set range: 001 to 100digit
(000.1 to 100.0)
Cooling OFF offset
C.oSt
000
Set range: 000 to 100digit
(000.0 to 100.0)
※Displayed only when temperature control type[ C-nd ] is set to onoF or on.on control.
※Displayed only when control output operation mode [ o-Ft ] is set to cooling[ CooL ] or heating and cooling[ H-C ].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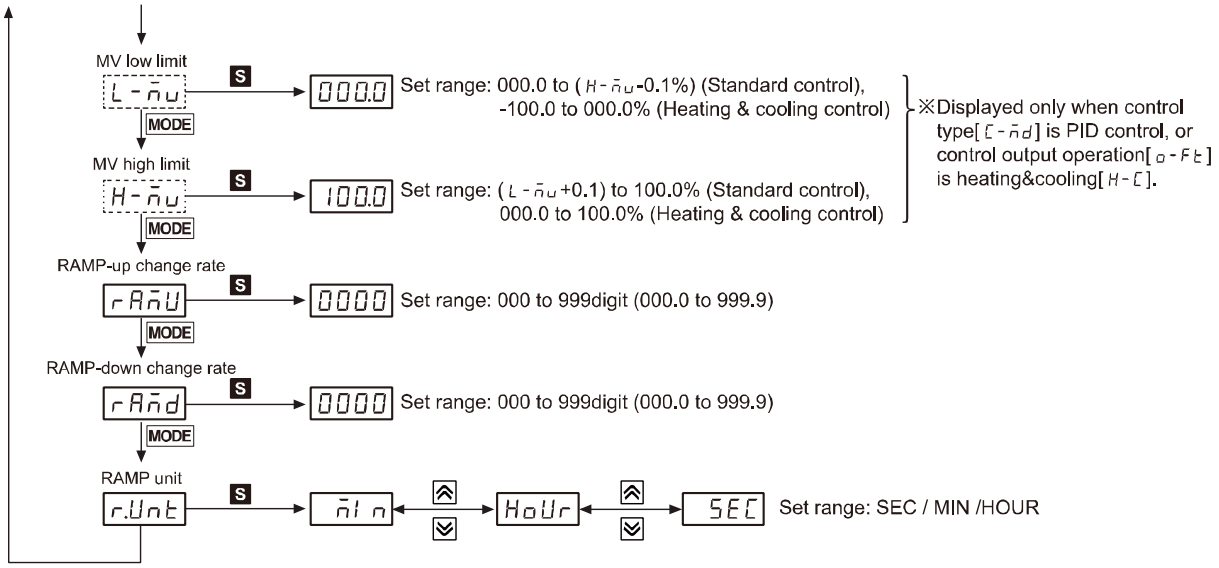
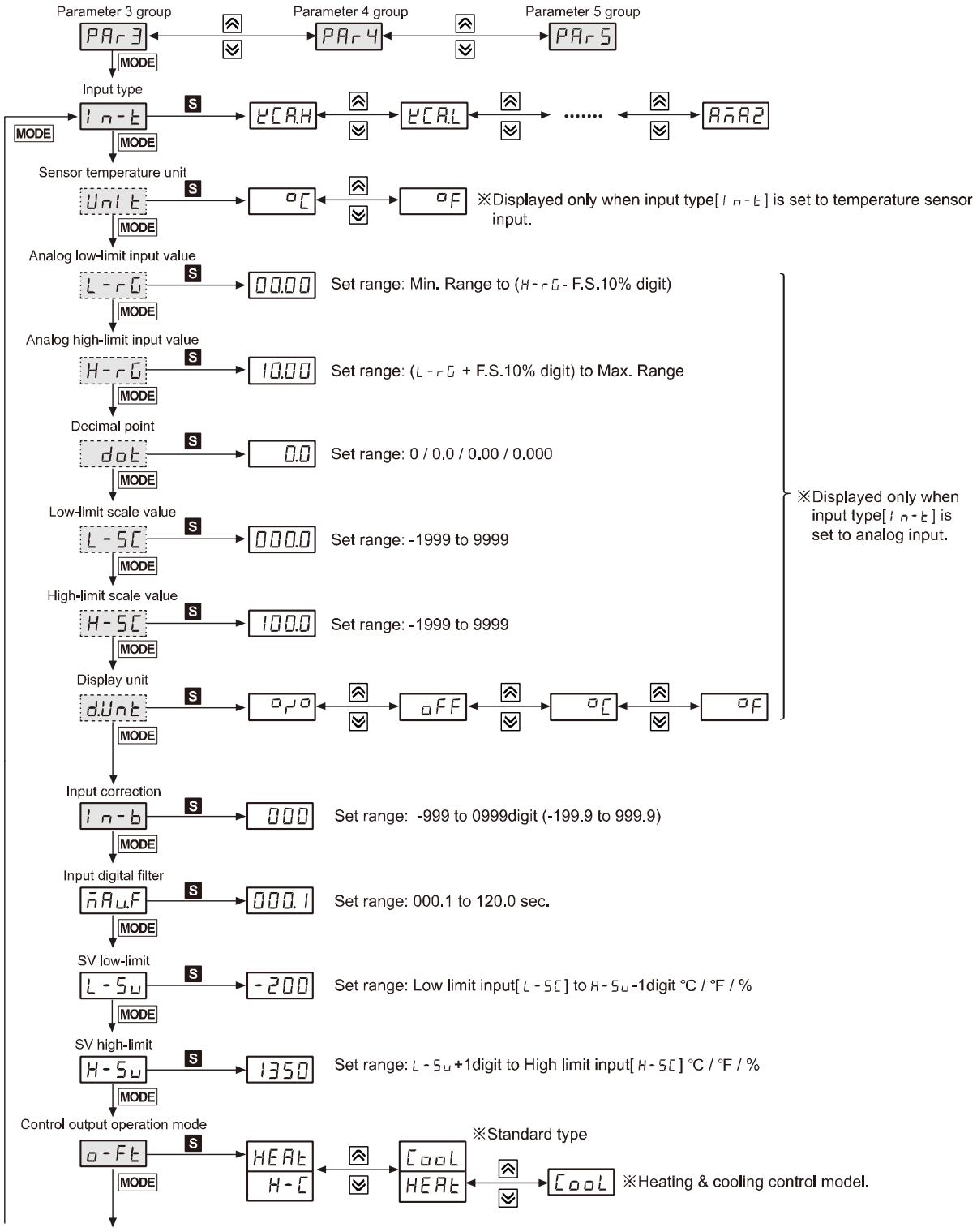

MV low limit
L-SU
MODE
000.0
Set range: 000.0 to (H-SU-0.1%) (Standard control),
-100.0 to 000.0% (Heating & cooling control)
※Displayed only when control type[C-Sd] is PID control, or control output operation[o-Fb] is heating&cooling[H-C].
MV high limit
H-SU
MODE
100.0
Set range: (L-SU+0.1) to 100.0% (Standard control),
000.0 to 100.0% (Heating & cooling control)
RAMP-up change rate
rASU
MODE
0000
Set range: 000 to 999digit (000.0 to 999.9)
RAMP-down change rate
rASd
MODE
0000
Set range: 000 to 999digit (000.0 to 999.9)
RAMP unit
r.Unt
MIn
HoUr
SEC
Set range: SEC / MIN /HOUR
S

## 5.4.3 Parameter 3 group [PAr3]

※1: S : Press any key among ≪, ▽, △
※After entering setting mode, press MODE key anytime for 3 sec. to return to Run mode.
※After entering setting mode, press MODE key anytime for 1.5 sec. to go to the concerned group name.
※If you press the MODE key after changing the setting value of the parameter the setting value will be stored.
※ Shaded parameters are for standard-level users, the others are for high-level users.
(You can set the user level in parameter 5 group)
※ This parameter might not be displayed depending on other parameter settings.





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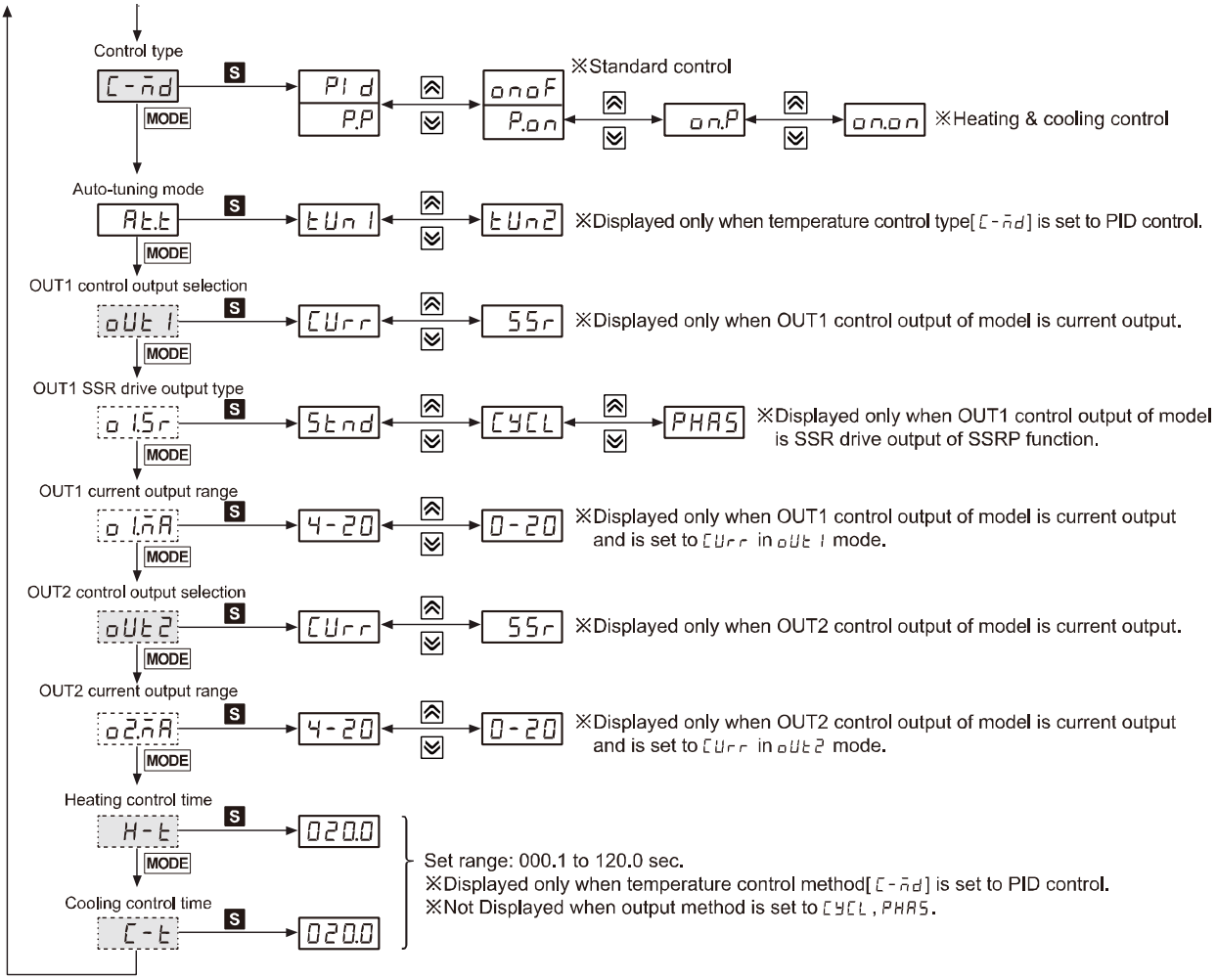
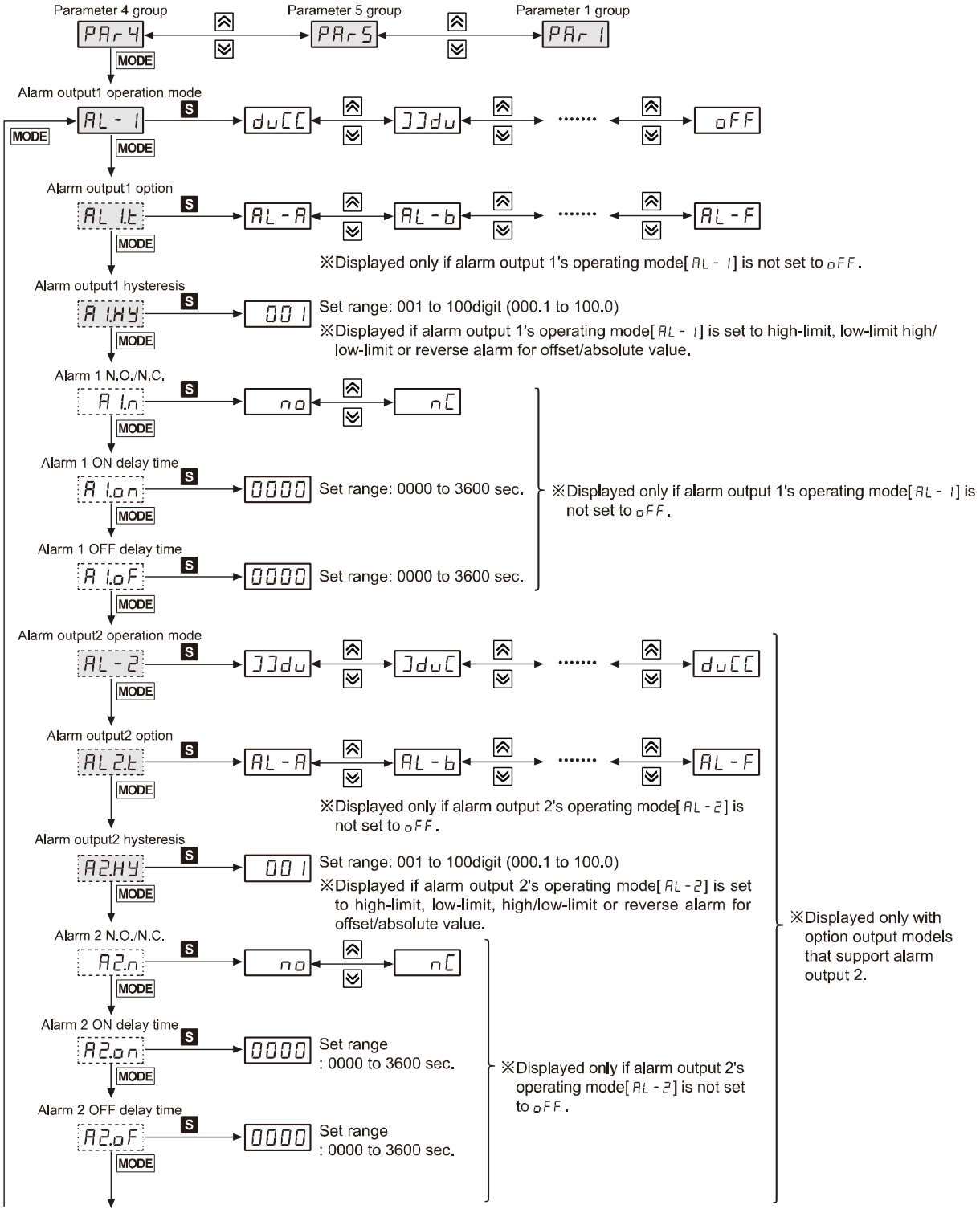



※ OUT1, OUT2 output:

- In case that OUT1, OUT2 output is relay output type
  : oUt1, o1Sr, o1nA, oUt2, o2Sr, o2nA parameters are not displayed.
- In case that OUT1,OUT2 output is current + SSR drive output type, when OUT1,OUT2 output is set to SSr
  : Output method of o1Sr, o2Sr is held in Stnd and parameter is not displayed.
- In case that OUT1, output is SSR drive output model of SSRP function and OUT2 output is current + SSR drive output
  -oUt1,o1nA are not displayed.
  -o1Sr can set to Stnd, CYCL, PHAS
  -When o2Sr is set to SSr it is held in Stnd and parameter is not displayed.

## 5.4.4 Parameter 4 group [PAr4]

※1: S : Press any key among ≪, ≫, ≪
※After entering setting mode, press MODE key anytime for 3 sec. to return to Run mode.
※After entering setting mode, press MODE key anytime for 1.5 sec. to go to the concerned group name.
※If you press the MODE key after changing the setting value of the parameter the setting value will be stored.
※ Shaded parameters are for standard-level users, the others are for high-level users.
(You can set the user level in parameter 5 group)
※ This parameter might not be displayed depending on other parameter settings.





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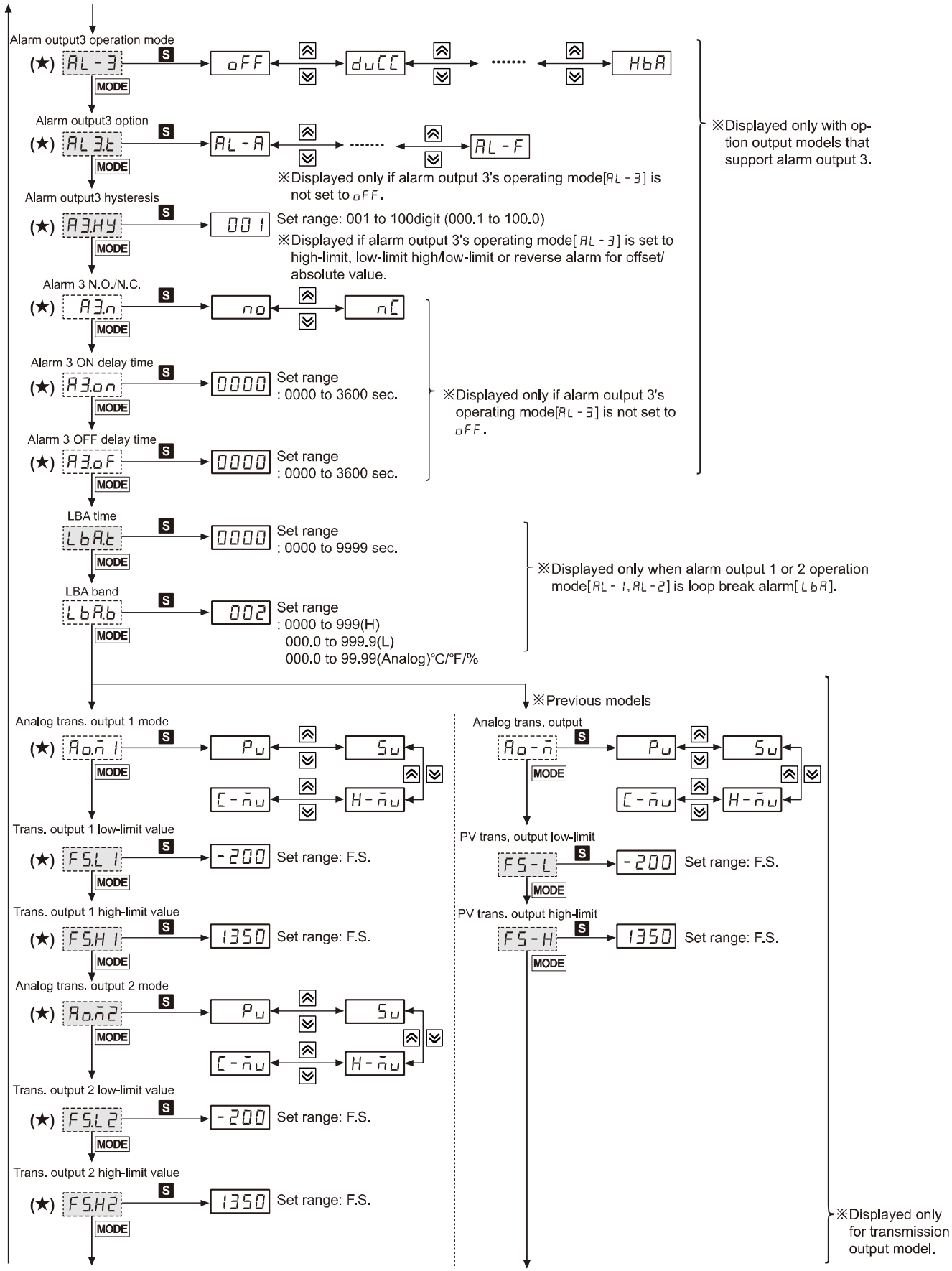
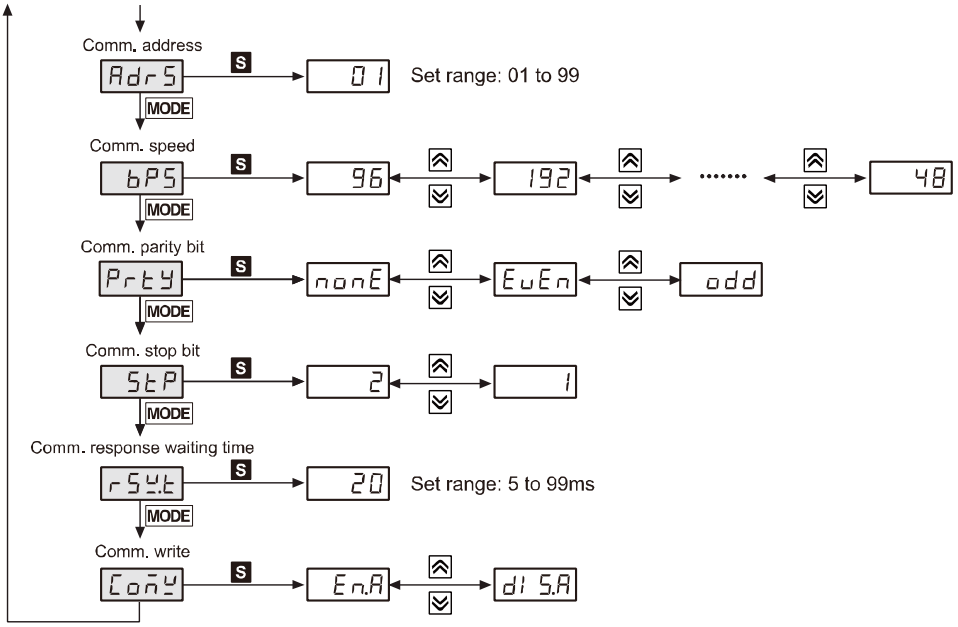

Alarm output3 operation mode
(★) AL-3
S
MODE
oFF
duCC
HbA
※Displayed only with option output models that support alarm output 3.
Alarm output3 option
(★) AL3t
AL-A
AL-F
※Displayed only if alarm output 3's operating mode[AL-3] is not set to oFF.
Alarm output3 hysteresis
(★) A3HY
001
Set range: 001 to 100digit (000.1 to 100.0)
※Displayed if alarm output 3's operating mode[AL-3] is set to high-limit, low-limit high/low-limit or reverse alarm for offset/absolute value.
Alarm 3 N.O./N.C.
(★) A3n
no
nC
Alarm 3 ON delay time
(★) A3on
0000
Set range : 0000 to 3600 sec.
Alarm 3 OFF delay time
(★) A3oF
0000
Set range : 0000 to 3600 sec.
※Displayed only if alarm output 3's operating mode[AL-3] is not set to oFF.
LBA time
LbAt
0000
Set range : 0000 to 9999 sec.
LBA band
LbAb
002
Set range : 0000 to 999(H) 000.0 to 999.9(L) 000.0 to 99.99(Analog)℃/℉/%
※Displayed only when alarm output 1 or 2 operation mode[AL-1,AL-2] is loop break alarm[LbA].
※Previous models
Analog trans. output 1 mode
(★) Ao.n1
Pu
Su
C-nu
H-nu
Trans. output 1 low-limit value
(★) FSL1
-200
Set range: F.S.
Trans. output 1 high-limit value
(★) FSH1
1350
Set range: F.S.
Analog trans. output 2 mode
(★) Ao.n2
Trans. output 2 low-limit value
(★) FSL2
-200
Set range: F.S.
Trans. output 2 high-limit value
(★) FSH2
1350
Set range: F.S.
Analog trans. output
Ao-n
PV trans. output low-limit
FS-L
-200
Set range: F.S.
PV trans. output high-limit
FS-H
1350
Set range: F.S.
※Displayed only for transmission output model.





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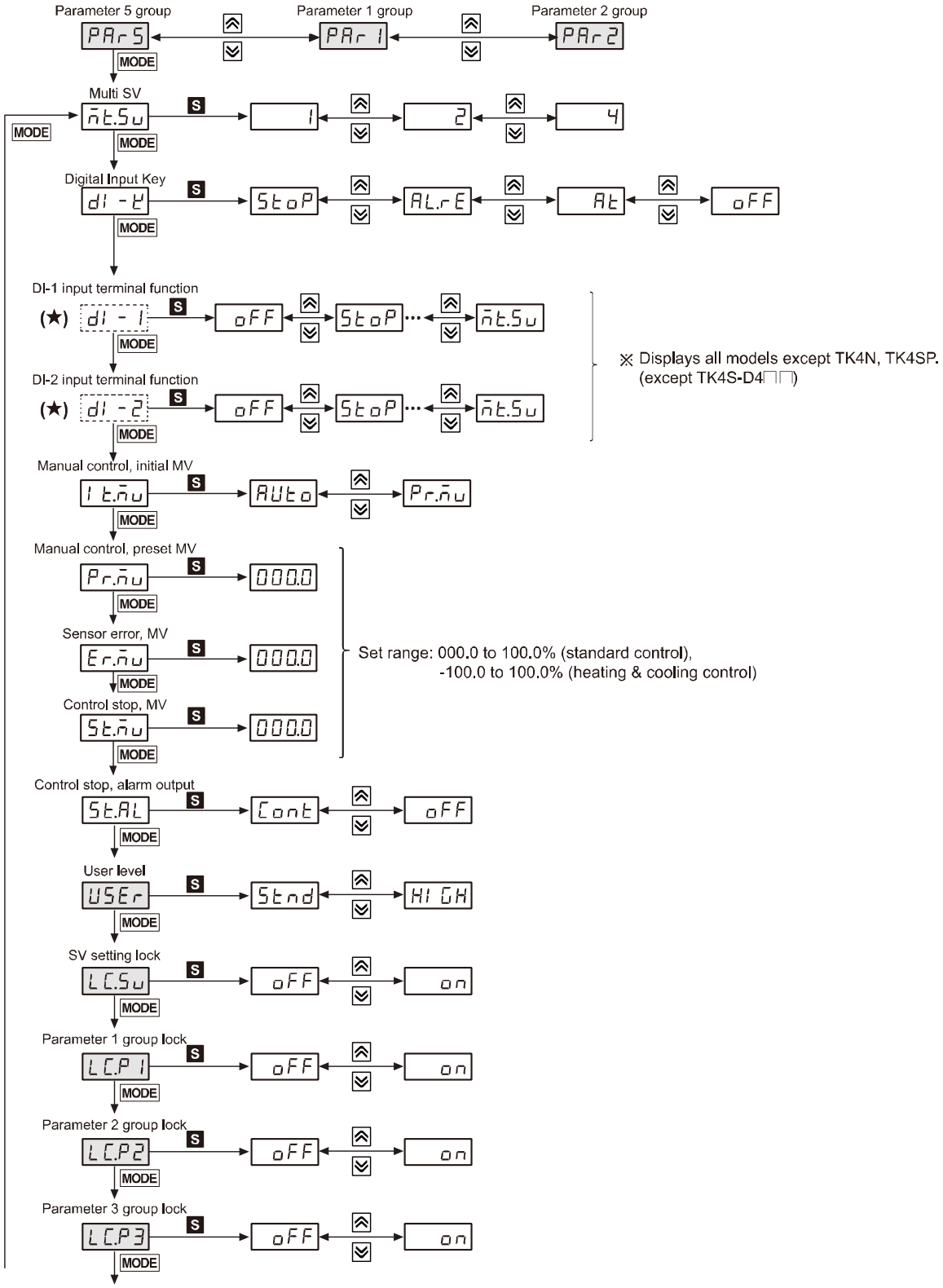
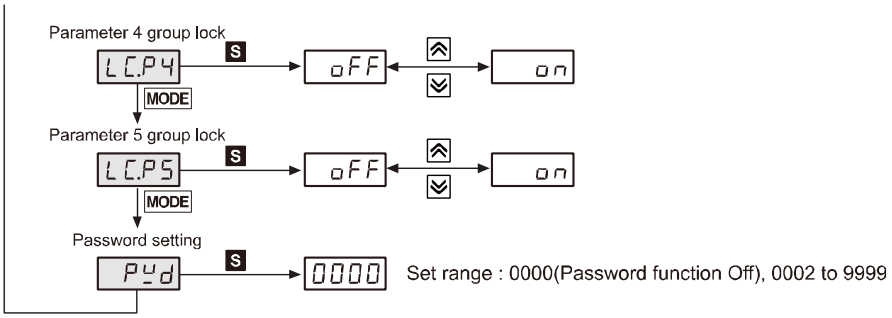
## 5.4.5 Parameter 5 group [PAr5]

※1: S : Press any key among ≪, ≫, ≪
※After entering setting mode, press MODE key anytime for 3 sec. to return to Run mode.
※After entering setting mode, press MODE key anytime for 1.5 sec. to go to the concerned group name.
※If you press the MODE key after changing the setting value of the parameter the setting value will be stored.
※ Shaded parameters are for standard-level users, the others are for high-level users.
(You can set the user level in parameter 5 group)
※ This parameter might not be displayed depending on other parameter settings.







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# 6 Parameter Settings and Functions

## 6.1 Input

### 6.1.1 Input types and temperature ranges

| Input types | | | Display | Temperature range (℃) | Temperature range (℉) |
|---|---|---|---|---|---|
| Thermocouple (TC) | K (CA) | 1 | K CA.H | -200 to 1350 | -328 to 2463 |
| | | 0.1 | K CA.L | -199.9 to 999.9 | -199.9 to 999.9 |
| | J (IC) | 1 | J I C.H | -200 to 800 | -328 to 1472 |
| | | 0.1 | J I C.L | -199.9 to 800.0 | -199.9 to 999.9 |
| | E (CR) | 1 | E C r.H | -200 to 800 | -328 to 1472 |
| | | 0.1 | E C r.L | -199.9 to 800.0 | -199.9 to 999.9 |
| | T (CC) | 1 | t C C.H | -200 to 400 | -328 to 752 |
| | | 0.1 | t C C.L | -199.9 to 400.0 | -199.9 to 752.0 |
| | B (PR) | 1 | b Pr | 0 to 1800 | 32 to 3272 |
| | R (PR) | 1 | r Pr | 0 to 1750 | 32 to 3182 |
| | S (PR) | 1 | S Pr | 0 to 1750 | 32 to 3182 |
| | N (NN) | 1 | n nn | -200 to 1300 | -328 to 2372 |
| | C (TT)※1 | 1 | C tt | 0 to 2300 | 32 to 4172 |
| | G (TT)※2 | 1 | G tt | 0 to 2300 | 32 to 4172 |
| | L (IC) | 1 | L I C.H | -200 to 900 | -328 to 1652 |
| | | 0.1 | L I C.L | -199.9 to 900.0 | -199.9 to 999.9 |
| | U (CC) | 1 | U C C.H | -200 to 400 | -328 to 752 |
| | | 0.1 | U C C.L | -199.9 to 400.0 | -199.9 to 752,0 |
| | Platinel II | 1 | PL I I | 0 to 1390 | 32 to 2534 |
| RTD | Cu 50Ω | 0.1 | Cu 5 | -199.9 to 200.0 | -199.9 to 392.0 |
| | Cu 100Ω | 0.1 | Cu 10 | -199.9 to 200.0 | -199.9 to 392.0 |
| | JPt 100Ω | 1 | JPt.H | -200 to 650 | -328 to 1202 |
| | JPt 100Ω | 0.1 | JPt.L | -199.9 to 650.0 | -199.9 to 999.9 |
| | DPt 50Ω | 0.1 | dPt.5 | -199.9 to 600.0 | -199.9 to 999.9 |
| | DPt 100Ω | 1 | dPt.H | -200 to 650 | -328 to 1202 |
| | DPt 100Ω | 0.1 | dPt.L | -199.9 to 650.0 | -199.9 to 999.9 |
| | Nickel 120Ω | 1 | nI 12 | -80 to 200 | -112 to 392 |

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| Input types | | | Display | Temperature range (℃) | Temperature range (℉) |
|---|---|---|---|---|---|
| Analog | Voltage | 0 to 10V | Au 1 | -1999 to 9999<br>(Display point will be changed according to decimal point position) | |
| | | 0 to 5V | Au2 | | |
| | | 1 to 5V | Au3 | | |
| | | 0 to 100mV | An u 1 | | |
| | Current | 0 to 20mA | AnA 1 | | |
| | | 4 to 20mA | AnA2 | | |

※1. C (TT): Same temperature sensor as former W5 (TT).

※2. G(TT): Same temperature sensor as former W (TT).

Note

Temperature sensors are to convert subject temperature to electrical signals for the temperature controller allowing it to control output.

SV (Setting Value) can only be set within the input range and do not set over the input range.

### 6.1.2 Input type [PAr3 → In-t]

This product supports multiple input types, making it possible for the user to choose from thermocouples, resistors, and analog voltage/current.

If you change the input specification, the SV's upper/low-limits are automatically set to the new specification's max/min values for temperature sensors. As for analog inputs, analog upper/lower input values are set to the max/min temperature range and the SV upper/low-limits set to upper/lower scale values. Therefore, you need to reconfigure the settings.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr3 | In-t | Refer to 6.1.1. Input types and temperature | K CA.H | - |

### 6.1.3 Sensor temperature unit [PAr3 → Unit]

When selecting the input temperature sensor, you can set the desired units (℃, ℉) of temperature/scale value to be displayed.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr3 | Unit | °C / °F | °C | - |

Note

This parameter will not be displayed if analog input has been selected.


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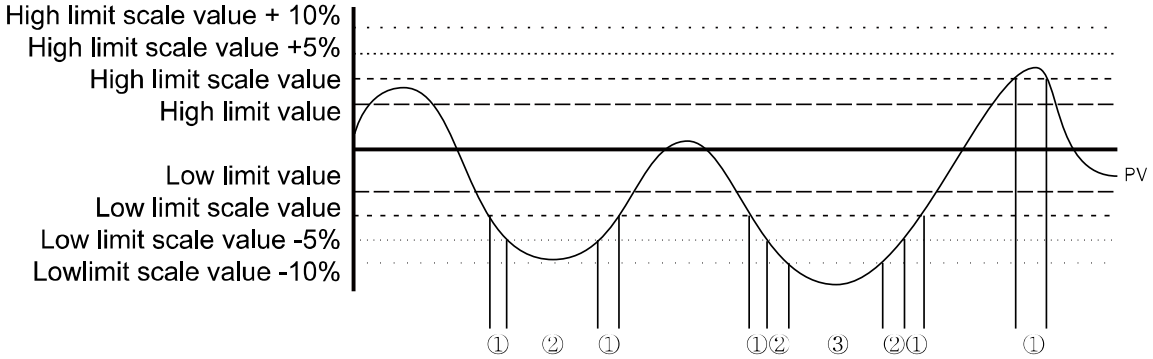
## 6.1.4 Analog input/scale value

With analog input selected, you can set the analog input range (high/low limit input values) and the display scale (high/low limit scale values) within the designated input range.

The decimal point positions remain fixed when configuring the high/low limit input values. You can change the input values at Au 1: 00.00, Au2/Au3: 0.000, Ān u 1: 000.0, ĀnA 1/ĀnA2: 00.00 decimal points.

If the upper and lower limit scale settings are identical, Err flashes twice and setting mode is displayed.

For analog input, ±5% of the set high/low limit input value is extended. Analog output is also extended compairing input value. (For temperature sensor input, ±5% extension is applied within the temperature range.)


High limit scale value + 10%
High limit scale value +5%
High limit scale value
High limit value
Low limit value
Low limit scale value
Low limit scale value -5%
Lowlimit scale value -10%
PV
① ② ① ①② ③ ②① ①

| No. | PV | Display |
|---|---|---|
| ① | ±5% section | Flashes PV |
| ② | ±5 to 10% section | Flashes HHHH or LLLL |
| ③ | Over ±10% section | Flashes oPEn |

**Note**

This parameter is not displayed for temperature sensor input.

### 6.1.4.1 Low-limit input value [PAr 3 → L -rG]

You can set the low limit input values for actual use within the analog input range.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr 3 | L -rG | Minimum temperature range to high-limit input value [H -rG] - F.S. 10% | 00.00 | - |

### 6.1.4.2 High-limit input value [PAr 3 → H -rG]

You can set high limit input values for actual use within the analog input range.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr 3 | H -rG | Low-limit input value [L -rG] + F.S. 10% to maximum temperature range | 10.00 | - |

### 6.1.4.3 Scale decimal point position [PAr3 → dot]

You can set the decimal point positions for present value (PV) and set value(SV) within high and low limit scale values.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr3 | dot | 0 / 0.0 / 0.00 / 0.000 | 0.0 | - |

### 6.1.4.4 Low-limit scale value [PAr3 → L-SC]

You can set the display scales of low-limit values for analog input [L-rG]. (Based on the decimal point position setting.)

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr3 | L-SC | -1999 to 9999 | 000.0 | - |

### 6.1.4.5 High-limit scale value [PAr3 → H-SC]

You can set the display scales of high-limit values for analog input [H-rG]. (Based on the decimal point position setting.)

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr3 | H-SC | -1999 to 9999 | 100.0 | - |

### 6.1.4.6 Display unit for front panel [PAr3 → d.Unt]

When you select an analog input type, you can set the display units.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr3 | d.Unt | °C / °F / °r.o / oFF | °r.o | - |

| Setting | Parameter description |
|---|---|
| °C | Sets the display unit to ℃ and turns on the ℃ of front unit indicator. |
| °F | Sets the display unit to ℉ and turns on the ℉ of front unit indicator. |
| °r.o | Sets the display unit to % and turns on the % of front unit indicator. |
| oFF | Sets the display unit to an undefined unit. The LED unit indicator will not turn on. |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### 6.1.5 Input correction [PAr3 → In-b]

This feature is used to compensate for input correction produced by thermocouples, RTDs, or analog input devices, NOT by the controller itself.

The Input correction function is mainly used when the sensor cannot be attached directly to controlled objects. It is also used to compensate for temperature variance between the sensor's installation point and the actual measuring point.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr3 | In-b | -999 to 0999 (temperature H, analog)<br>-199.9 to 999.9 (temperature L) | 0000 | ℃/℉/- |

Ex.

If the controller displays 78℃ when the actual temperature is 80℃, set the input correction [In-b] as '002' in order to adjust the controller's display temperature to 80℃.

If present value after input correction is out of the input range by each input sensor, it displays 'HHHH' or 'LLLL'.

Note

Make sure that an accurate temperature variance measurement is taken before set values of input correction. An inaccurate initial measurement can lead to greater variance.

Many of today's temperature sensors are graded by their sensitivity. Since higher accuracy usually comes at a higher cost, most people tend to choose sensors with medium sensitivity. Measuring each sensor's sensitivity correction for input correction feature in order to ensure higher accuracy in temperature reading.

### 6.1.6 Input digital filter [PAr3 → nAu.F]

It is not possible to perform stable control if the present value (PV) fluctuates because of fast changes of input signal. Using the Input digital Filter function can stabilize PV to realize more reliable control.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr3 | nAu.F | 000.1 to 120.0 | 0.1 | Sec |

Ex.

If the input digital filter is set to 0.4 sec., digital filtering is applied to a sampling value collected over 0.4 sec. (400 ms).

Note

When the input digital filter is used, present value (PV) can vary from the actual input value.

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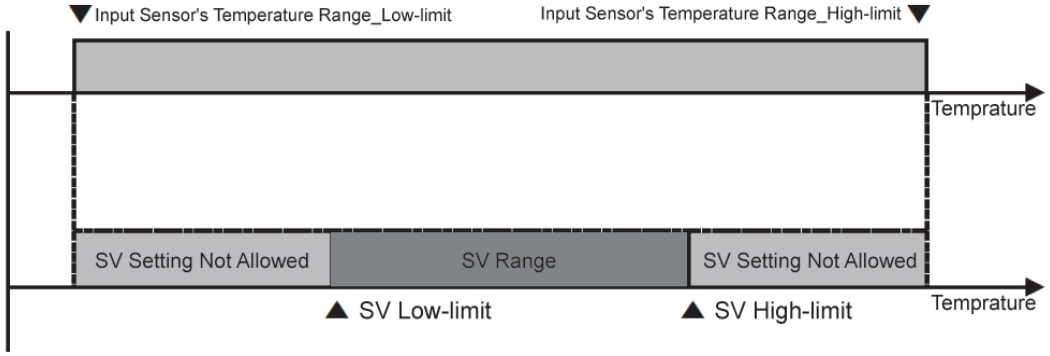
## 6.1.7 High/Low-limit value of setting value(SV) [PAr3 → H-Su/L-Su]

You can limit the Set value(SV) range within the temperature range of the temperature sensor or analog input type in order to prevent the system from controlling with improper SV.




| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr3 | H-Su | SV low-limit + 1 digit to sensor input high-limit or analog high-limit scale value | 1350 (temperature)<br>1000 (analog) | ℃/℉ |
| | L-Su | Sensor low-limit or analog low-limit scale value to SV high-limit - 1 digit | -200 (temperature)<br>100.0 (analog) | ℃/℉ |

| Parameter | Parameter Description |
|---|---|
| L-Su | Set value(SV) low-limit |
| H-Su | Set value(SV) high-limit |

### Note

Attempts to set the limits outside the min/max input range, or analog's high/low-limits, are not accepted. Instead, the previous settings are retained.

Set value(SV) can only be set within the SV low-limit [L-Su] and SV high-limit [H-Su] range.

SV lower-limit [L-Su] cannot exceed SV high-limit [H-Su].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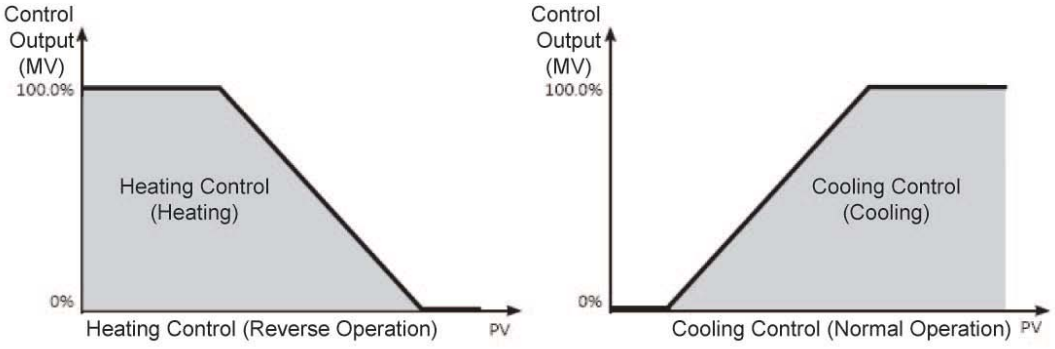
# 6.2 Control output

## 6.2.1 Control output mode [PAr3 → o-Ft]

- Control output modes for general temperature control include heating, cooling, and heating & cooling.
- Heating control and cooling control are mutually opposing operations with inverse outputs.
- The PID time constant varies based on the controlled objects during PID control.




| Setting group | Parameter | Set range | Factory default | Unit |
|---|---|---|---|---|
| PAr3 | o-Ft | Standard model: HEAt / CooL | HEAt | - |
| | | Heating/Cooling model: HEAt / CooL / H-C | H-C | - |

### 6.2.1.1 Heating control [PAr3 → o-Ft → HEAt]

Heating control mode: the output will be provided in order to supply power to the load (heater) if present value (PV) falls below set value(SV).

### 6.2.1.2 Cooling control [PAr3 → o-Ft → CooL]

Cooling control mode: the output will be provided in order to supply power to the load (cooler) if present value (PV) rises above set value(SV).

### 6.2.1.3 Heating & Cooling control [PAr3 → o-Ft → H-C]

Heating & Cooling control mode: heating & cooling with a single temperature controller when it is difficult to control subject temperature with only heating or cooling.

Heating & Cooling control mode controls the object using different PID time constants for each heating & Cooling.

It is also possible to set heating & cooling control in both PID control or ON/OFF control mode. Heating/cooling output can be selected among Relay output, SSR drive output and current output depending on model types choosen according to your application environment. (Note that SSR drive output of OUT2 operates standard control.)

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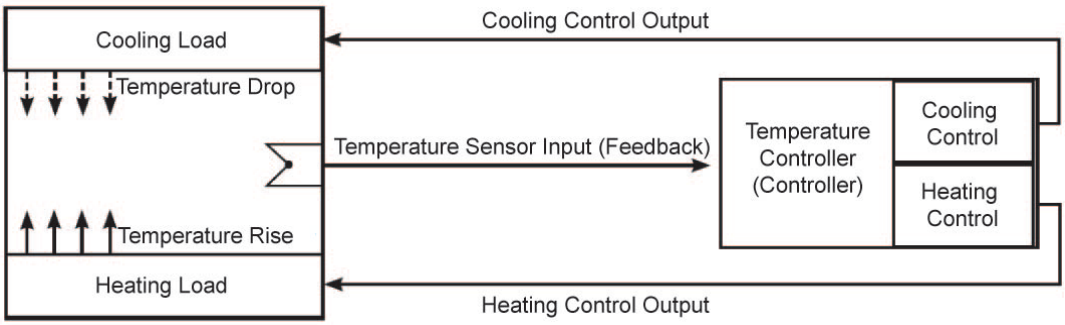


**Note**

For heating & cooling control, OUT1 control output is dedicated to heating control and OUT2 control output to cooling control.

### 6.2.1.3.1. Dead band/Overlap band [PAr2 → db]

In heating & cooling control, it is possible to designate a dead band between heating & cooling control bands based on set value(SV).

A dead band forms around the SV when positive (+) value is set. No control occurs in the dead band area. Therefore, heating & cooling MVs become 0.0% in the formed dead band.

An overlap band (simultaneous application of heating & cooling MVs) forms around the SV when negative (-) value is set.

Set as 0 when a dead band or an overlap band is not used.

When setting integration time, it is applied when the intengration time of heating control and cooling control is set. In case of PI-P control and P-PI control, it also operates as P-P control.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr2 | db | See below. | See below. | |

- PID/PID, PID/ON-OFF, and ON-OFF/PID Control
  - Set range (temperature): -(proportional band) to +(proportional band) (the lower value when using different proportional bands)
  - Set range (analog): -99.9 to 099.9
  - Factory default: 0000 (temperature H), 000.0 (temperature L, analog), (unit: temperature ℃/℉, analog % F.S.)
- ON-OFF/ON-OFF Control
  - Set range (temperature):

    -999 (overlap band) to 0000 (not used) to 0999 (dead band) (temperature H)

    -199.9 (overlap band) to 000.0 (not used) to 999.9 (dead band) (temperature L)
  - Set range (analog): -99.9 (overlap band) to 000.0 (not used) to 099.9 (dead band)
  - Factory default: 0000 (temperature H), 000.0 (temperature L, analog), (unit: temperature ℃/℉, analog % F.S.)


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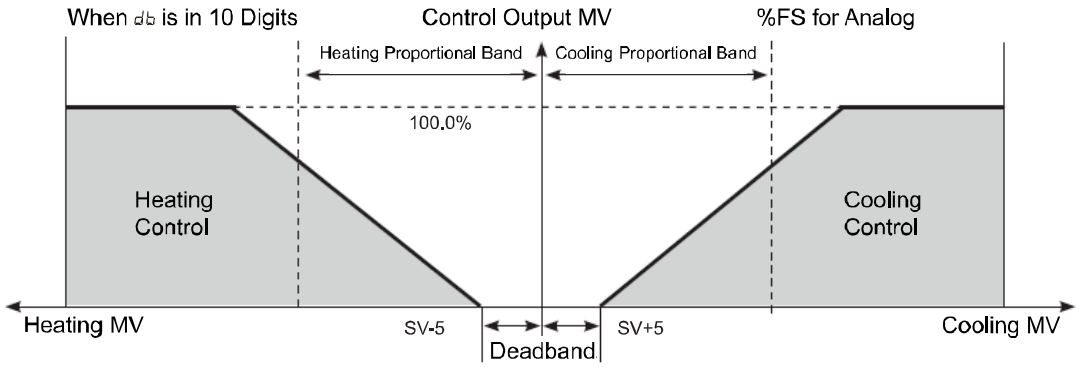
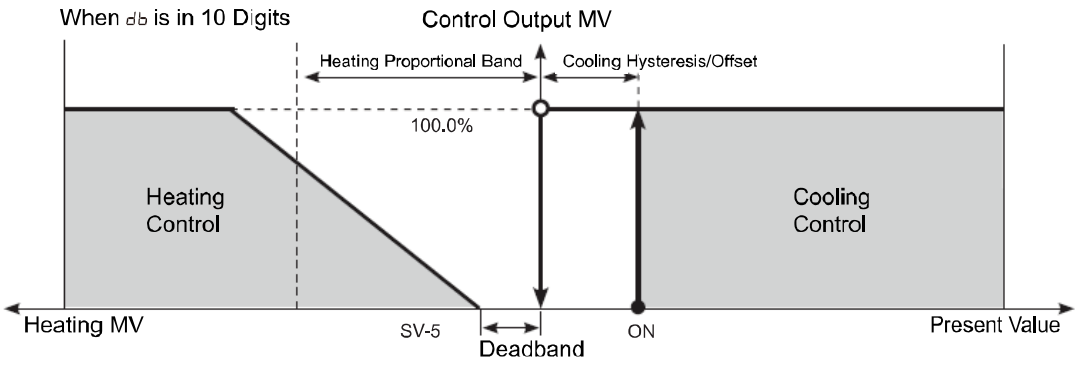
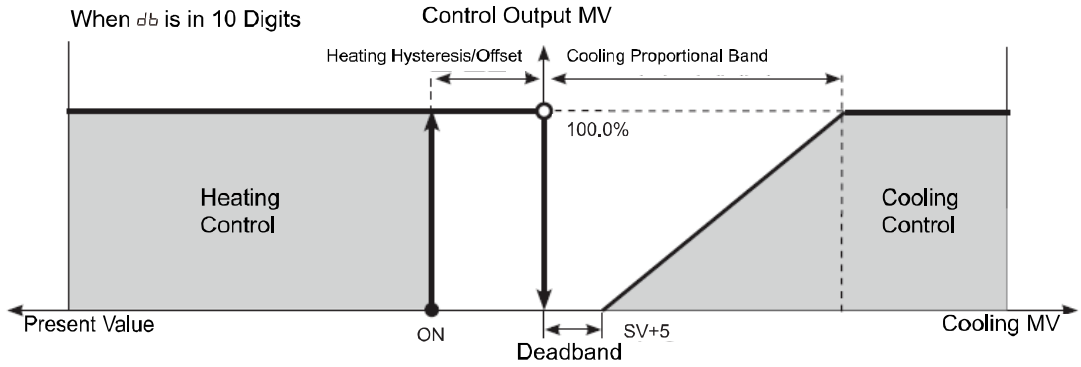
### (1) Using a Deadband



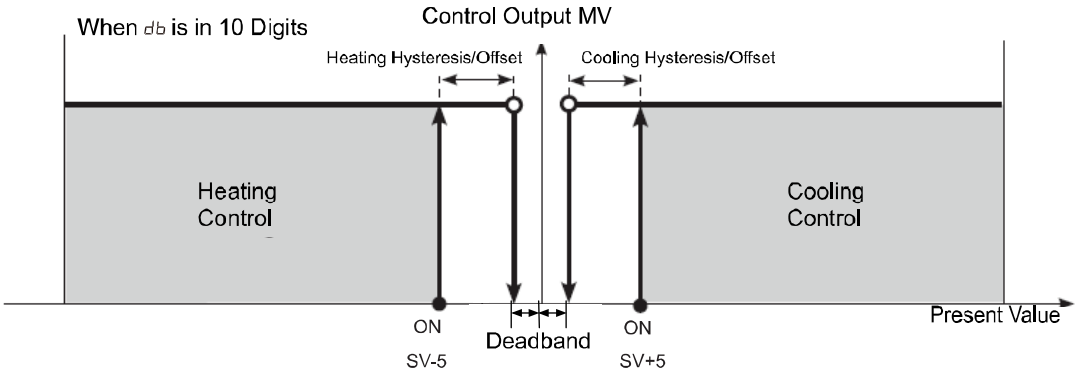

<PID-PID Control with Heating and Cooling Control>




<PID-ON/OFF Control with Heating and Cooling Control>




<ON/OFF-PID Control with Heating and Cooling Control>




<ON/OFF-ON/OFF Control with Heating and Cooling Control>

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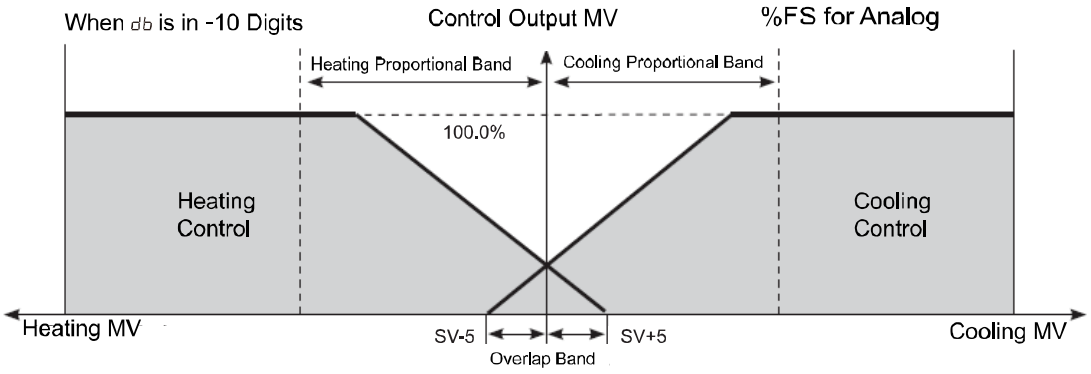
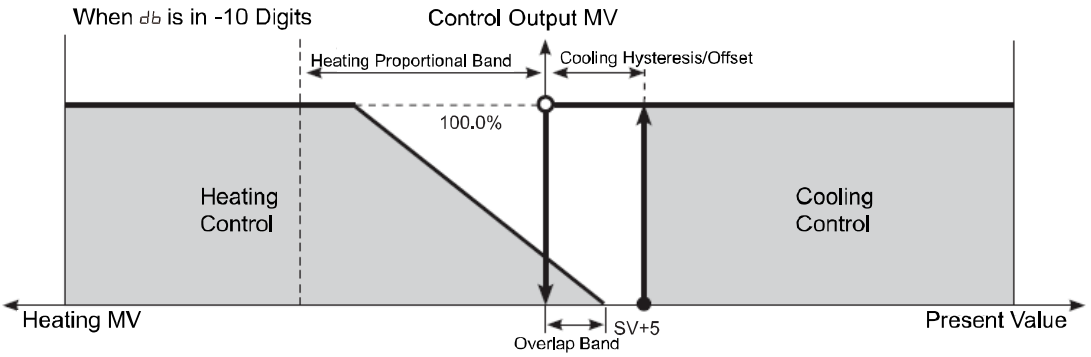
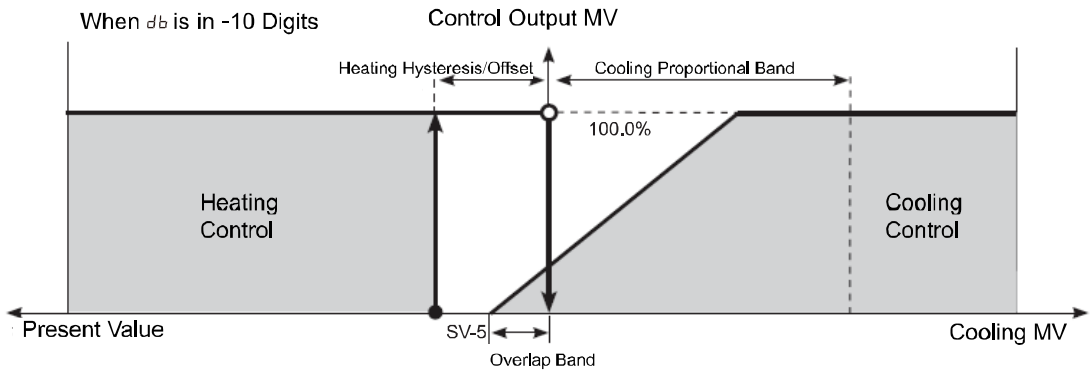
## (2) Using an Overlap Band



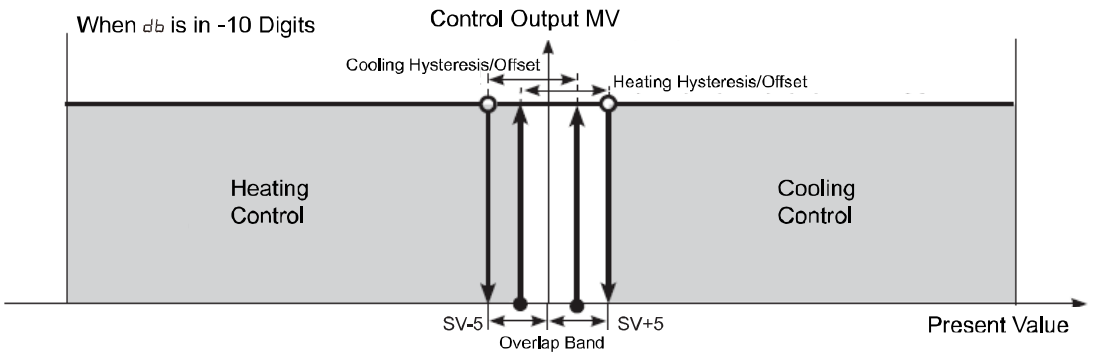

<PID-PID Control with Heating and Cooling Control>




<PID-ON/OFF Control with Heating and Cooling Control>




<ON/OFF-PID Control with Heating and Cooling Control>




<ON/OFF-ON/OFF Control with Heating and Cooling Control>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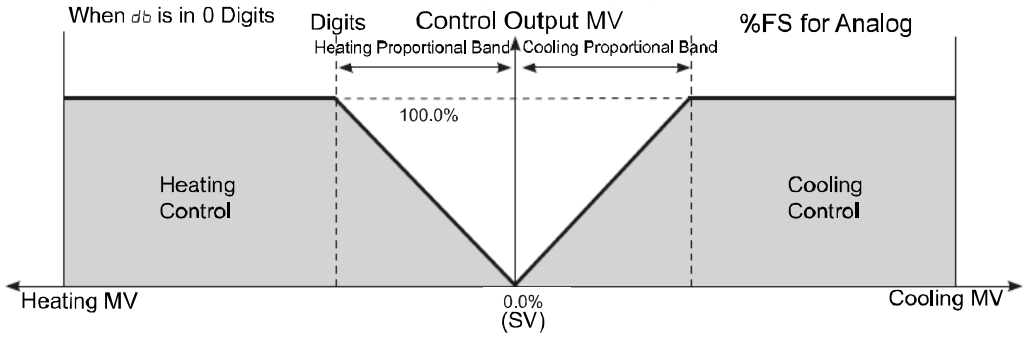
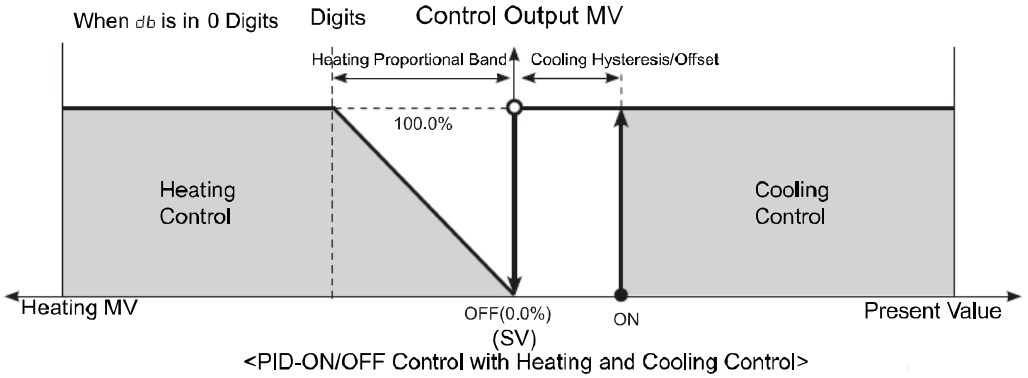
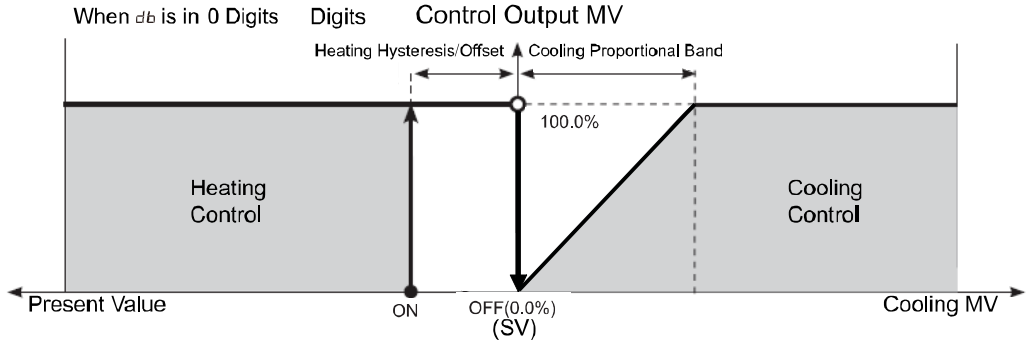
### (3) Using neither a Dead band nor an Overlap Band



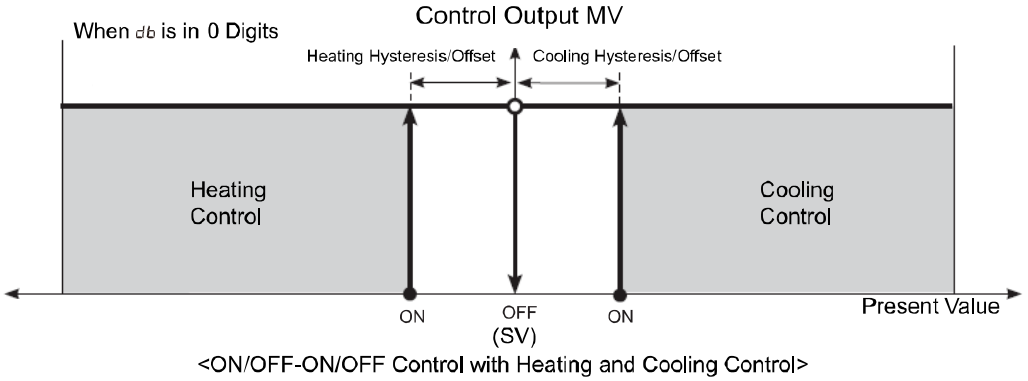

<PID-PID Control with Heating and Cooling Control>




<PID-ON/OFF Control with Heating and Cooling Control>




<ON/OFF-PID Control with Heating and Cooling Control>




<ON/OFF-ON/OFF Control with Heating and Cooling Control>

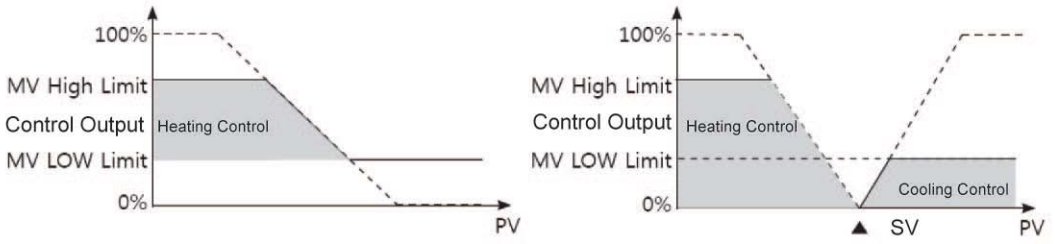
**Note**

Depends on the set value of the heating integration time[H-I ], cooling integration time[C-I ], actual operation may be different.

## 6.2.2 MV High/Low-limit value settings [PAr2 → H-ou / L-ou]

MV high/low-limit values [H-ou / L-ou] for control output can be configured to the actual MV, provided the temperature controller's MV calculation exceeds the limits.

During heating & cooling control, cooling MV carries a "-" prefix. Therefore, the high-limit is expressed as a + value on the heating side and the low-limit as a - value on the cooling side.




<Standard Control (Heating Control)> <Heating and Cooling Control>

| Parameter | Description |
|---|---|
| L-ou | MV Low-limit value setting |
| H-ou | MV High-limit value setting |

| Setting group | Parameter | Set range | Factory default | Unit |
|---|---|---|---|---|
| PAr2 | H-ou | Standard Control: MV Low-limit value [L-ou] + 0.1 to 100.0 | 100.0 | % |
| | | Heating & Cooling Control: 000.0 to 100.0 (PID control)<br>0.0 (OFF)/ 100.0 (ON) (ON/OFF control) | 100.0 | % |
| | L-ou | Standard Control: 000.0 to MV high-limit value [H-ou] – 0.1 | 0.0 | % |
| | | Heating & Cooling Control: -100.0 to 000.0 (PID control), -100.0 (ON)/ 0.0 (OFF) (ON/OFF control) | -100.0 | % |

### Note

Same MV limits applied during auto-tuning.

MV limits are not applied to manual control, MV upon control stop, MV upon a sensor error, and initial manual control MV.

MV high/low-limit configuration is not available for ON/OFF control in standard control mode (heating or cooling control).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## 6.2.3 Ramp settings [PAr2 → rAnU / rAnd / r.Unt]

Ramp is a feature used to configure the slope toward set value(SV). The feature limits change rate of set value(SV) and thereby restricts sudden temperature changes (increase and decrease) in the control subject.

Ramp is commonly used in applications where rapid temperature changes (increase and decrease) could impact negatively on the control subject.

| Parameter | Description |
|---|---|
| rAnU | Settings for Ramp-up change rate. |
| rAnd | Settings for Ramp-down change rate. |
| r.Unt | Settings for Ramp time unit. |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr2 | rAnU | 000 to 999 (temperature H, analog),<br>000.0 to 999.9 (temperature L) | 000 | |
| | rAnd | 000 to 999 (temperature H, analog),<br>000.0 to 999.9 (temperature L) | 000 | |
| | r.Unt | SEC (seconds), Min (minutes),<br>HoUr (hours) | Min | - |

### Note

Activating the ramp feature when the ramp is not in operation limits the change rate of Set value(SV) based on present value (PV). Changing SV or ramp parameters while the ramp is in operation limits the change rate of SV based on SV at the point of the change.

Control will be carried out based on changed SV (hereinafter referred to as RAMP SV) - changed by preset change rate (slope). RAMP-Up Change Rate and RAMP-Down Change Rate can be configured independently.

Alarm operation during RAMP will be made based on final SV.

Setting the rate of ramp change to 0 deactivates the ramp feature.

If the ramp feature has been activated, RAMP SV will be displayed on SV display part.

Ramp depending on operation status

| Operation Status | Ramp Up/Down | Ramp |
|---|---|---|
| All operations | When it is 0. | Inactive |
| oPEn, HHHH, LLLL, Auto-tuning, Switching from Auto to Manual, Switching from Run to Stop | Irrespective of conditions. | Inactive |
| oPEn, HHHH, LLLL, After Auto-tuning completed, PV = SV | Irrespective of conditions. | Inactive |
| Power On, SV Change, Switching from Stop to Run, Switching from Manual to Auto, Ramp Rate Change | When it is not 0. | Active |

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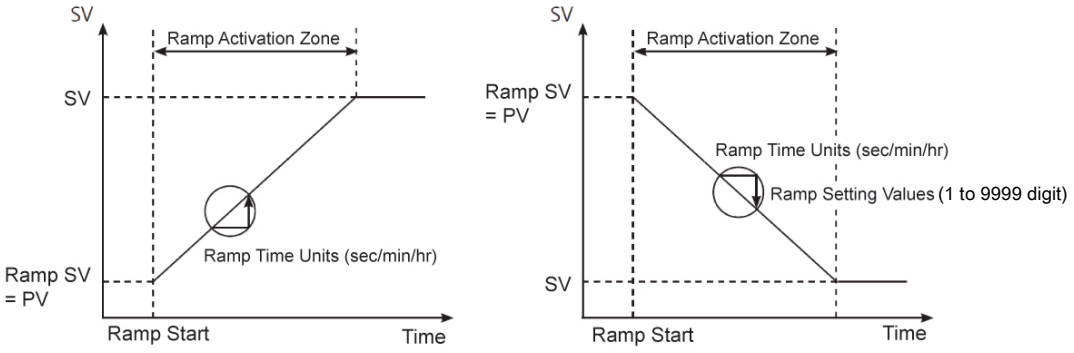
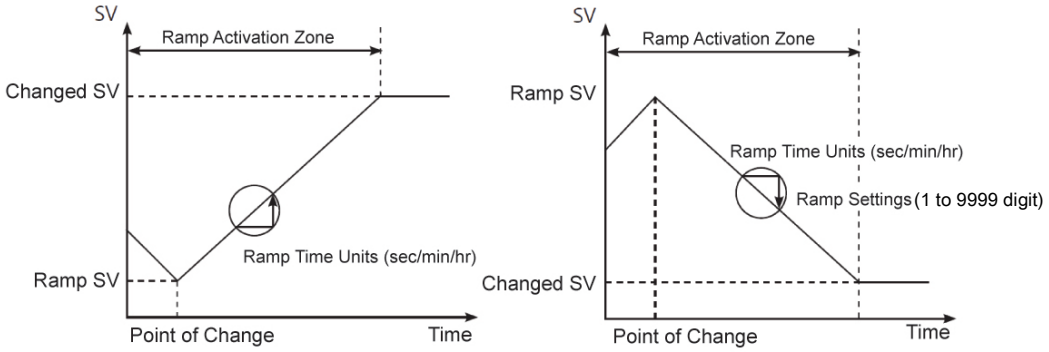
Ramp operation graph




<Activating Ramp when Ramp is not in operation>




<Changing SV or Ramp Parameter when Ramp is in operation>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## 6.2.4 Auto/Manual control settings

Auto control mode is to make temperature reach SV with MV calculated by PID control. Manual control mode is to make temperature reach SV with user's defined MV.

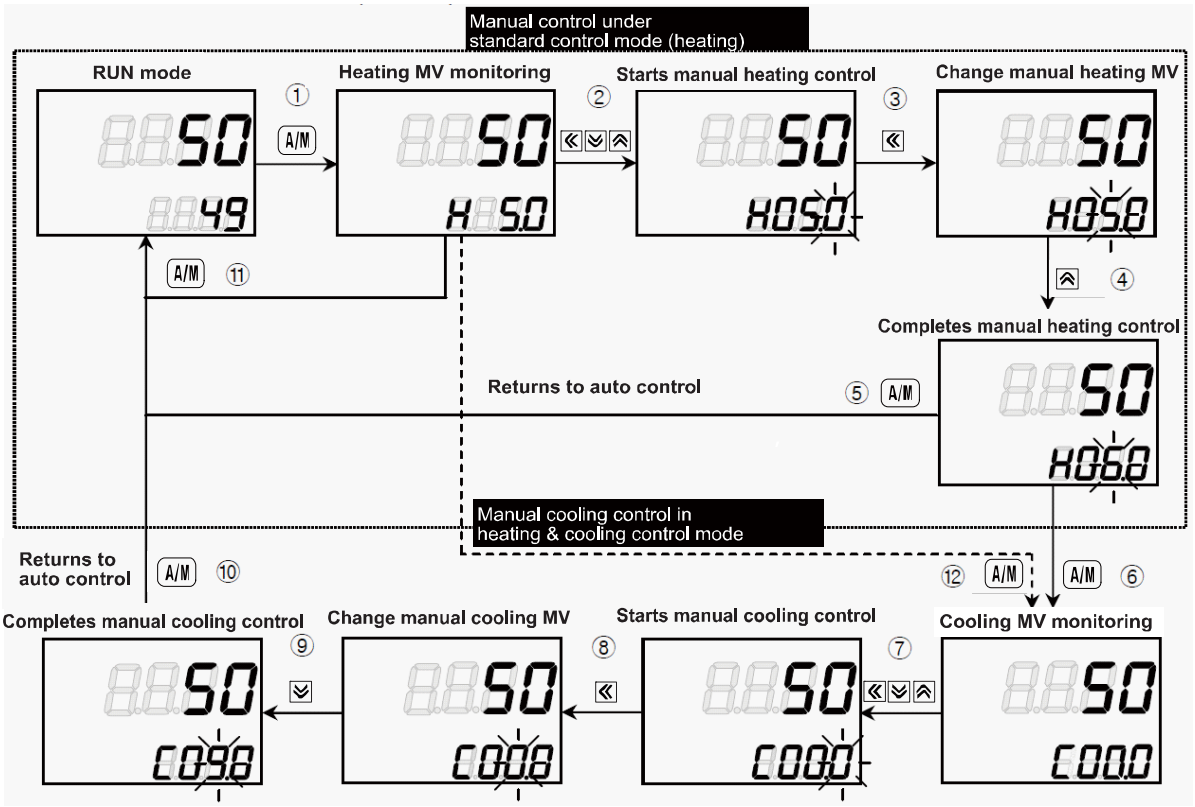
**Note**

When in manual control mode, parameter settings can only be viewed and cannot be modified (except for lock parameters). When digital input terminal function is set as Auto/Manual control, the A/M key (the MODE key for TK4N, TK4S, TK4SP) and the Auto/Manual swithcing by communication do not operate. When the unit is powered on following a power interruption or shutdown, previous control mode (auto or manual) will be maintained.

If switching to manual control during Auto-tuning, Auto-tuning will be terminated. It is still possible to switch to manual control mode while in STOP. When a sensor break alarm [5bA] occurs in standard control mode, the sensor error MV [Er.mu] is applied. In this state, manual and auto control MV settings can be modified. It is still possible to switch auto/manual control mode while in controlling operation.

Operation Priority: Manual Control > Stop > Open (Sensor Disconnection)

### 6.2.4.1 Manual/Auto control switching




#### (1) Manual control switching for standard control (heating or cooling control)

- ①, ⑤: When in RUN mode, press the A/M key (the MODE key for TK4N, TK4S, TK4SP model) and it enters MV monitoring mode. The SV display shows H (heating control) or C (cooling control), and shows MV to indicate the start of MV monitoring.
- ②, ⑥: If the ≪ ≫ ∧ is pressed when MV monitoring is in progress, the MAN indicator comes on and the lowest digit ($10^0$ digit) starts to flash, indicating activation of manual control.
- ③, ⑦: Press the ≪ key to change the flashing digit ($10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0$).

- ④, ⑧: Select the digit and configure the desired MV value using the keys moving to 0→1→2→3→4→5→6→7→8→9→0 by the keys.
- ⑨: In ① to ⑧ status, press the key(the key for TK4N, TK4S, TK4SP model) to end manual control. The MAN indicator goes off and the system reverts to auto control mode.

### (2) Manual control switching for heating & cooling control

- ①: When in RUN mode, press the key (the key for TK4N, TK4S, TK4SP model) and it enters heating MV monitoring mode. The SV display shows 'H' and shows MV to indicate the start of heating MV monitoring.
- ②: If the is pressed when heating MV monitoring is in progress, the MAN indicator comes on and the lowest digit ($10^0$ digit) starts to flash, indicating activation of manual control.
- ③: Press the key to change the flashing digit ($10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0$).
- ④: Select the digit and configure the desired MV value using the keys moving to 0→1→2→3→4→5→6→7→8→9→0 by the keys.
- ⑤: In ① to ④ status, press the key( key for N, S, SP model) and it enters cooling MV monitoring mode. The SV display shows 'C' and shows MV to indicate the start of cooling MV monitoring.
- ⑥: If the is pressed when cooling MV monitoring is in progress, the lowest digit ($10^0$ digit) starts to flash.
- ⑦: Press the key to change the flashing digit ($10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0$).
- ⑧: Select the digit and configure the desired MV value using the keys moving to 0→1→2→3→4→5→6→7→8→9→0 by the keys.
- ⑨: In ⑤ to ⑧ status, press the key(the key for TK4N, TK4S, TK4SP model) to end manual control. The MAN indicator goes off and the system reverts to auto control mode.

**Note**

After heating & cooling control, the system reverts to auto control in sequence of heating monitoring, manual heating control, cooling monitoring, and manual cooling control.

Heating MV remains in effect during cooling monitoring and manual cooling control.

TK4N/S/SP (W48×H48mm) does not have the key. Press the key once to change between auto and manual controls.

If the digital Input [dI - 1, dI - 2] feature has been set for AUTO/MANUAL, the key ( the key for TK4N, TK4S and TK4SP model) key located on the front and automatic/manual control functions via communication do not act.

### (3) Manual/Auto Control switching with the digital input (DI) terminal

If the digital Input (DI) feature has been configured for manual/auto control switching, turn on the DI to activate manual control (MAN indicator goes on) and turn off the DI to activate auto control. If the digital Input feature is automatic control status, you can be only to monitor. In case it is manual control status, modifying MV and monitoring are possible.

**Note**

See 6.7.4 Digital input, for detailed information on digital Input (DI) terminal settings.

When MV parameter is masked, MV parameter cannot be monitored and changed.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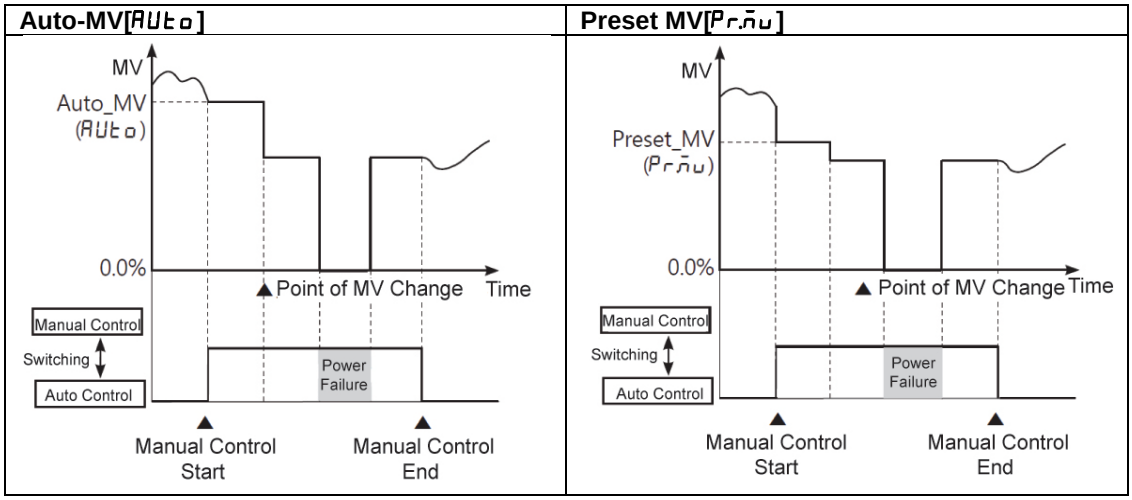
### 6.2.4.2 Baseline MV for manual control [PAr5 → I t.mU]

When switching from auto control [AUto] to manual control [Pr.mU] you can set the initial MV.

- AUto: Controlling with auto control MV as an initial MV for manual control
- Pr.mU: Controlling with preset manual MV [Pr.mU] as an initial MV.




| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr5 | I t.mU | AUto / Pr.mU | AUto | - |

**Note**

When re-supplying the power, it controls with the MV which is at the power OFF.

### 6.2.4.3 Initial MV for manual control [PAr5 → Pr.mU]

If the baseline MV for manual control is configured to Pr.mU (Preset Manual MV), you can set the initial MV for manual control.

| Setting group | Parameter | Setting range | | | Factory default | Unit |
|---|---|---|---|---|---|---|
| PAr5 | Pr.mU | Standard control | ON/OFF control | 000.0 (OFF) / 100.0 (ON) | 000.0 | % |
| | | | PID control | 000.0 to 100.0 | | |
| | | Heating & Cooling control | ON/OFF control | -100.0 (Cooling ON) / 000.0 (OFF) / 100.0 (Heating ON) | | |
| | | | PID control | -100.0 (Cooling) to 000.0 (OFF) to 100.0 (Heating) | | |

**Note**

When in heating & cooling control mode, a setting between 0.1 and 100.0 will be applied as heating MV and a setting between 0.1 and -100.0 will be applied as cooling MV.

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## 6.2.5 Output settings

### 6.2.5.1 Control output (OUT1/OUT2) selection [PAr3 → oUt1/oUt2]

- In case of selecting the Models with current control output, both current and SSR drive outputs are available. You can therefore choose the right output type depending on application environments.
- oUt1: Selects OUT1 control output.
- oUt2: Selects OUT2 control output.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr3 | oUt1 | SSr / CUrr | SSr | - |
| | oUt2 | | | |

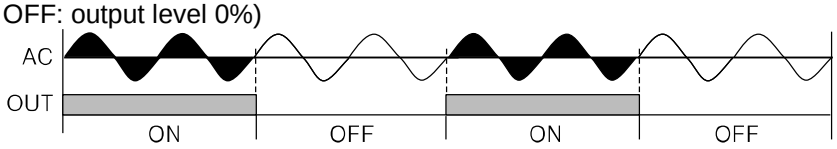
### 6.2.5.2 SSRP function [PAr3 → o1Sr]

SSRP function of SSR drive output is selectable one of standard ON/OFF control, cycle, phase control. By parameter setting, standard SSR drive is available. Also, cycle control connecting with a zero cross turn-on method SSR, phase control connectiong with a random turn-on method SSR are available.

Realizing high accuracy and cost effective temperature control with both current output (4-20mA) and linear output(cycle control and phase control).

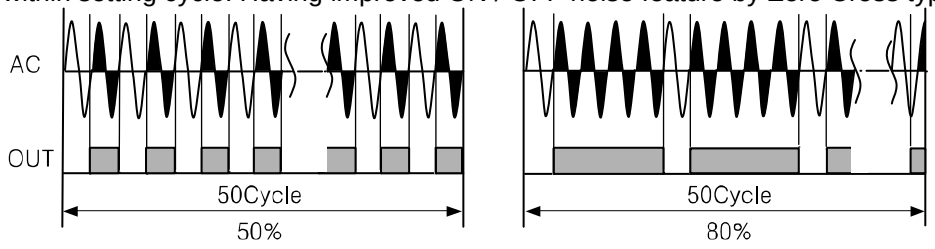
#### (1) Standard ON/OFF control [Stnd]

A mode to control the load in the same way as Relay output type.(ON: output level 100%, OFF: output level 0%)



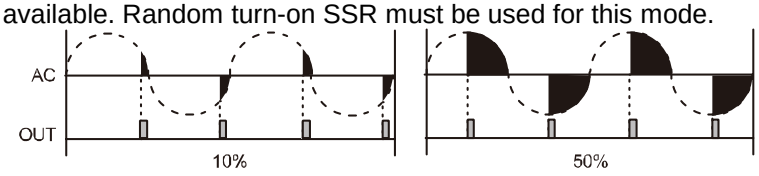

#### (2) Cycle control [CYCL]

A mode to control the load by repeating output ON / OFF according to the rate of output within setting cycle. Having improved ON / OFF noise feature by Zero Cross type.




#### (3) Phase control [PHAS]

A mode to control the load by controlling the phase within AC half cycle. Serial control is available. Random turn-on SSR must be used for this mode.




| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr3 | o1Sr | Stnd / CYCL / PHAS | Stnd | - |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Note

- Make sure that SSRP function is not available for OUT2. In case of current type models, SSR is fixed to standard output [Stnd] only.
- When selecting cycle output [CYCL] or phase output [PHAS], the power supply for the load and temperature controllers must be the same.
- In case of selecting SSRP function whether cycle output [CYCL] or phase output [PHAS] with PID control type, control cycle is not available to set.

#### 6.2.5.3 Current output range settings [PAr3 → o1.nA/o2.nA]

If the control output is set to current output, you can select upper and low-limit range for the current output as either 4-20mA or 0-20mA.

- o1.nA: Sets OUT1's current output range.
- o2.nA: Sets OUT2's current output range.

Note

This parameter is only available on models supporting current output [oUt1, oUt2].

## 6.3 Temperature control

### 6.3.1 Temperature control mode [PAr3 → C-nd]

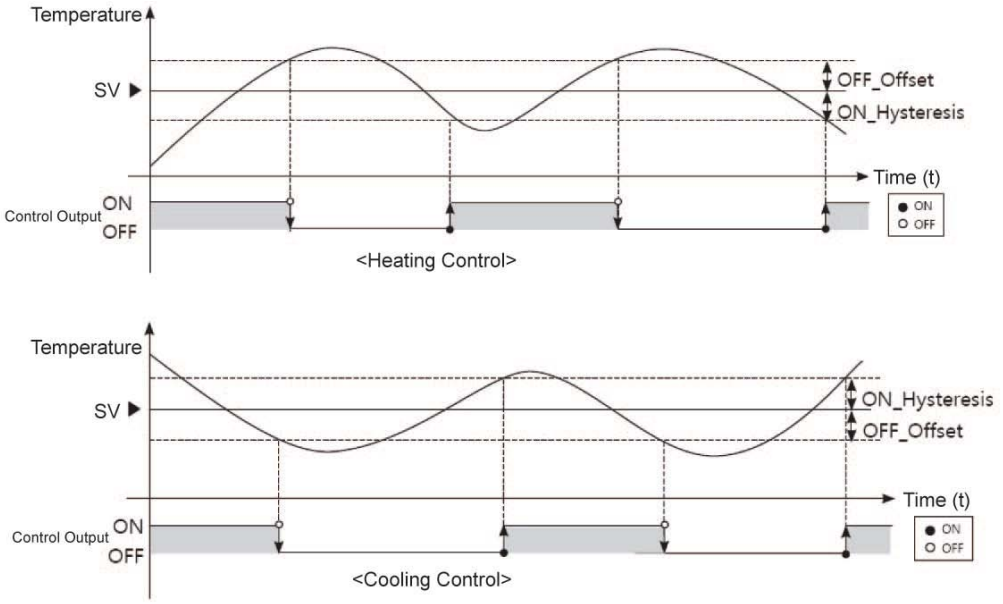
You can choose the type of temperature control method.

| Setting | | Description | |
|---|---|---|---|
| | | Heating | Cooling |
| Standard Control | Pid | PID control | |
| | onoF | ON/OFF control | |
| Heating & Cooling Control | P.P | PID control | PID control |
| | P.on | PID control | ON/OFF control |
| | on.P | ON/OFF control | PID control |
| | on.on | ON/OFF control | ON/OFF control |

| Setting group | Parameter | Setting range | | Factory default | Unit |
|---|---|---|---|---|---|
| PAr3 | C-nd | Standard Control | Pid / onoF | Pid | - |
| | | Heating & Cooling Control | P.P / P.on / on.P / on.on | P.P | |

## 6.3.2 ON/OFF control [PAr3 → C-nd → onoF]

Controls the temperature by comparing present value (PV) with set value(SV) and turning power to the load on or off.




### 6.3.2.1 Hysteresis [PAr2 → H.HYS/H.oFt/C.HYS/C.oFt]

Hysteresis is to adjust control output ON/OFF point in ON/OFF control mode. ON_Hysteresis sets the output on point and OFF_Offset sets the off point.

Setting hysteresis too low can result in hunting induced by disturbance (noise, chattering, etc.). To minimize hunting, set ON_Hysteresis and OFF_Offset values with consideration to the heater or cooler's capacity and thermal characteristics, the control subject's response characteristics, the sensor's response characteristics and installation conditions, and other defining factors.

| Parameter | Description |
|---|---|
| H.HYS | Configures ON_Hysteresis for heating control. |
| H.oFt | Configures OFF_Offset for heating control. |
| C.HYS | Sets ON_Hysteresis for cooling control. |
| C.oFt | Sets OFF_Offset for cooling control. |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr2 | H.HYS | Temperature H, Analog: 001 to 100<br>Temperature L: 00.1 to 10.0 | 002 | °C/°F/- |
| | C.HYS | | | |
| | H.oFt | Temperature H, Analog: 001 to 100<br>Temperature L: 00.1 to 10.0 | 000 | |
| | C.oFt | | | |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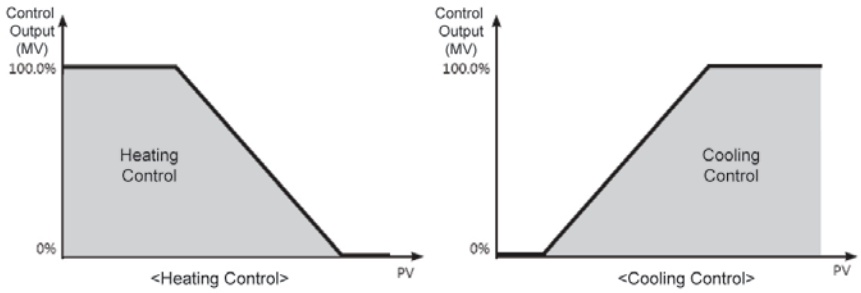
## 6.3.3 PID control [PAr3 → C-ñd → PId]

PID control is a combination of proportional (P), integral (I), and derivative (D) controls and offers superb control over the control subjects, even with a delay time.

Proportional control (P) implements smooth,
hunting-free control; integral control (I) automatically corrects offsets;
and derivative control (D) speeds up the response to disturbance. Through these actions, PID control realizes ideal temperature control.




**Note**

Applied PID Control Technique

- Proportional Control (P): Select PID control and set the integral and derivative time to 0000.
- Proportional Integral Control (PI): Select PID control and set the derivative time to 0000.
- Proportional Derivative Control (PD): Select PID control and set the integral time to 0000.
- Multi SV: Use the same PID time constant for the values of Su0 to Su3.

### 6.3.3.1 Proportional band settings [PAr2 → H-P/C-P]

When present value (PV) is within the Proportional Band (P), the ON/OFF ratio needs to be adjusted during the proportional period (T). The defined proportional control (time proportional control) section is called as the proportional band.

| Parameter | Description |
|---|---|
| H-P | Heating proportional band |
| C-P | Cooling proportional band |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr2 | H-P<br>C-P | 000.1 to 999.9 | 010.0 | Temperature: ℃/℉<br>Analog: % |

### 6.3.3.2 Integral time settings [PAr2 → H-I /C-I ]

MVs from integral and proportional operation become the same when deviation is consistent. The time taken for the two MVs to match is called the integral time.

| Parameter | Description |
|---|---|
| H-I | Heating integral time |
| C-I | Cooling integral time |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr2 | H-I<br>C-I | 0000 to 9999 | 0000 | Sec |

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Note

Integral control is not conducted if the integral time is set to 0.

Setting the integral time too short can intensify correction movements and cause hunting.

### 6.3.3.3 Derivative time settings [PAr2 → H-d/C-d]

In accordance with the deviation of the ramp, the time taken for the MV gained from derivative operation to reach the MV gained from proportional control is called the derivative time.

| Parameter | Description |
|---|---|
| H-d | Heating derivative time |
| C-d | Cooling derivative time |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr2 | H-d | 0000 to 9999 | 0000 | Sec |
| | C-d | | | |

Note

Derivative control is not conducted if the derivative time is set to 0.

### 6.3.3.4 Control period settings [PAr3 → H-t/C-t]

If relay or SSR is used to output MV under proportional control, the output is on for a fixed amount of time (within the control period, as a percentage of the MV) and then remains off for the rest of the time. The preset period when output ON/OFF takes place is called the proportional control period.

Control with SSR drive output has a faster response than that of relay output. Therefore, by configuring a shorter control period, more responsive temperature control is achieved.

| Parameter | Description |
|---|---|
| H-t | Heating control period |
| C-t | Cooling control period |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr3 | H-t | Relay, SSR drive output(ON/OFF control, phase control, cycle control): 000.1 to 120.0<br>Current output, SSR drive output: 000.1 to 120.0 | Relay output: 020.0<br>SSR drive output: 002.0 | Sec |
| | C-t | | | |

Note

If using heating & cooling control, configure each control period separately for heating & cooling.


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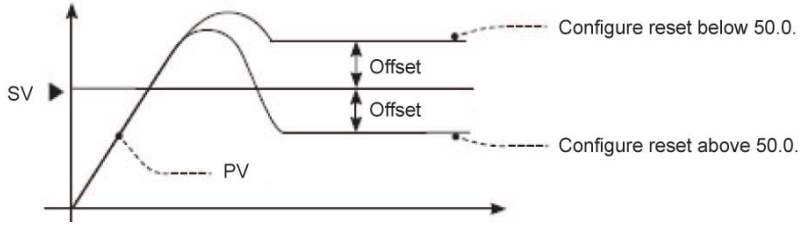
#### 6.3.3.5 Offset correction/Manual reset settings [PAr2 → rESt]

When selecting P / PD control mode, there are certain temperature differences even after PV reaches stable status since heater's rising and falling time is inconsistent due to thermal characteristics of control objects, such as heat capacity and the heater capacity. This temperature difference is called OFFSET. Offset can be corrected using manual reset.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr2 | rESt | 00.0 to 100.0 | 50.0 | % |

**(1) Manual Reset Adjustments based on Control Results**

Under stable control conditions, set the offset to 50% if PV and SV are identical, to over 50.0% if PV is lower than SV, and to below 50.0% if PV is higher than SV.




**Note**

The offset correction feature can only be used when proportional control is in effect. If setting the integral value to 0, the manual reset parameter will be displayed.

The user cannot configure the manual reset setting during heating & cooling control. Instead, the setting is automatically set to 0% for both heating & cooling.

Applicable only when integral time is set to 0 under P control or PD control only.

Switching from heating & cooling control to standard control (P, PD control) automatically configures the reset setting to 50%.

### 6.3.4 Auto-tuning

Auto tuning measures the control subject's thermal characteristics and thermal response rate, and then determines the necessary PID time constant. (When control type [C-nd] is set as PID, it is displayed.)

If error [oPEn] occurs during auto tuning, it stops this operation automatically.

To stop auto tuning, change the set as oFF. (It maintains P, I, D values of before auto tuning.)

#### 6.3.4.1 Auto-tuning start/stop setting [PAr2 → At]

- Auto-tuning automatically stores PID time constants upon termination. These PID time constants can then be modified by the user to suit their usage environment.
- When auto-tuning is in progress, the AT indicator located on the front of the controller flashes in 1 sec. intervals. When auto-tuning finishes, the AT indicator automatically goes off and the auto-tuning parameter will return to oFF.
- When auto-tuning is in progress and digital input key [dI-U] is STOP(switching RUN/STOP) or AT(auto-tuning RUN/STOP) is set, and digital input terminal function [dI-1, dI-2] is STOP (switching RUN/STOP) or MAN(AUTO/MANUAL control selection), auto-tuning will be automatically ended, if concerned DI is inputted or a sensor disconnection error occurs. (Restored the PID used prior to the auto-tuning session)

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| Setting | Description |
|---|---|
| oFF | Auto-tuning complete. |
| on | Auto-tuning in progress. |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr2 | At | oFF/on | oFF | - |

Note

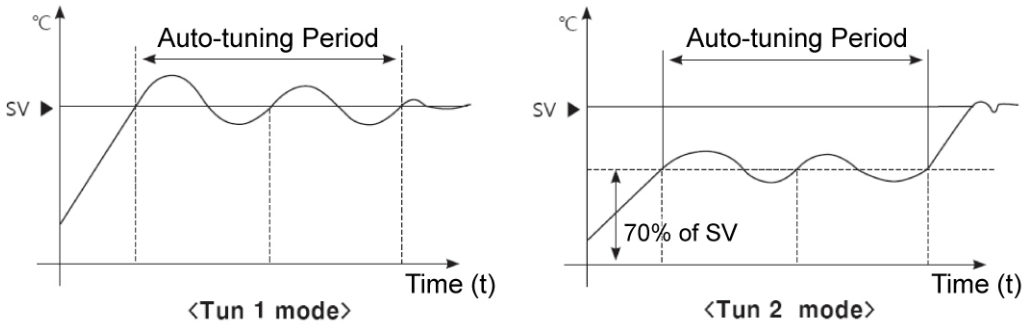
Auto-tuning continues to run even if the temperature reading exceeds or falls below the input range.

When auto-turning is in progress, parameters can only be referenced and not altered.

Auto-tuning is not available in manual control.

### 6.3.4.2 Auto-tuning mode settings [PAr3 → AtE]

Auto-tuning is available in [tUn1] mode (based on SV) or [tUn2] mode (based on 70% of SV), depending on the baseline value used.




〈Tun 1 mode〉 〈Tun 2 mode〉

| Setting | Description |
|---|---|
| tUn1 | Auto-tunes and derives a PID time constant based on set value(SV). |
| tUn2 | Auto-tunes and derives a PID time constant based on 70% of set value(SV). |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr3 | AtE | tUn1 / tUn2 | tUn1 | - |

Note

In cooling control mode, [tUn2] mode calculates 70% based at 0.

When SV=-100, [tUn2] is performed at -70.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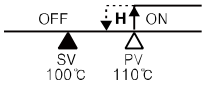
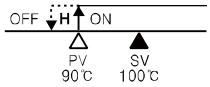
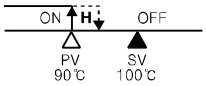
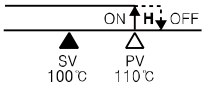
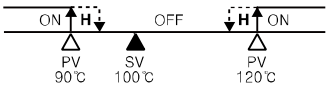
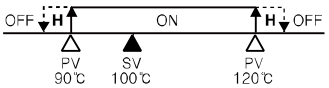
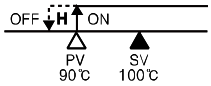
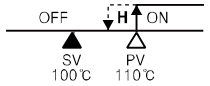
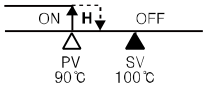
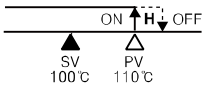
## 6.4 Alarm output

There are three alarms which operate individually. You can set combined qoralarm operation and alarm option. Use digital input setting as [AL.rE] or turn OFF power and re-start this unit to release alarm operation.

### 6.4.1 Alarm operation [PAr4 → AL-1/AL-2/AL-3]

Select the desired alarm operation.

| Mode | Name | Alarm operation | | Description (factory default) |
|---|---|---|---|---|
| oFF | - | - | | No alarm output |
| duCC | Deviation high-limit alarm |  High deviation: Set as 10℃ |  High deviation: Set as -10℃ | If deviation between PV and SV as high limit is higher than set value of deviation<br>temperature, the alarm output will be ON.<br>High-limit deviation temperature can be set in AL 1.H/AL 2.H/AL 3.H. |
| JJdu | Deviation low-limit alarm |  Lower deviation: Set as 10℃ |  Lower deviation: Set as -10℃ | If deviation between PV and SV as low limit is higher than set value of deviation temperature, the alarm output will be ON.<br>Low limit can be set in AL 1.L/AL 2.L/AL 3.H. |
| JduC | Deviation high/low-limit alarm |  Lower deviation: Set as 10℃,<br>High deviation: Set as 20℃ | | If deviation between PV and SV as high/low limit is higher than set value of deviation temperature, the alarm output will be ON.<br>High-limit Deviation Temperature can be set in AL 1.H/AL 2.H/AL 3.H.<br>Low limit can be set in AL 1.L/AL 2.L/AL 3.H. |
| CdUJ | Deviation high/low-limit reverse alarm |  Lower deviation: Set as 10℃,<br>High deviation: Set as 20℃ | | If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be OFF.<br>High-limit deviation can be set in AL 1.H/AL 2.H/AL 3.H.<br>Low limit deviation can be set in AL 1.L/AL 2.L/AL 3.H. |
| PuCC | Absolute value high limit alarm |  Alarm absolute value: Set as 90℃ |  Alarm absolute value: Set as 110℃ | If PV is higher than the absolute value, the output will be ON.<br>Alarm's absolute value can be set in AL 1.H/AL 2.H/AL 3.H. |
| JJPu | Absolute value low limit alarm |  Alarm absolute value: Set as 90℃ |  Alarm absolute value: Set as 110℃ | If PV is lower than the absolute value, the output will be ON.<br>Alarm's absolute value can be set in AL 1.L/AL 2.L/AL 3.H. |
| LbA | Loop break alarm | - | | It will be ON when it detects loop break. |

| Mode | Name | Alarm operation | Description (factory default) |
|---|---|---|---|
| SbA | Sensor break alarm | - | It will be ON when it detects sensor disconnection. |
| HbA | Heater break alarm | - | It will be ON when CT detects heater break. |

※H: Alarm output □ hysteresis [A□.HY]

| Parameter | Description |
|---|---|
| AL-1 | Selects alarm output 1 operation mode. |
| AL-2 | Selects alarm output 2 operation mode. |
| AL-3 | Selects alarm output 3 operation mode. |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr4 | AL-1 | oFF / duCC / ]]du / ]duC / [du] / PuCC / ]]Pu / SbA / LbA / HbA | duCC | - |
| | AL-2 | | ]]du | |
| | AL-3 | | oFF | |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## 6.4.2 Alarm output options [PAr 4 → AL 1.t/AL2.t]

Users can select the desired alarm output options.

| Setting | Mode | Description |
|---|---|---|
| AL-A | Standard Alarm | If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF. |
| AL-b | Alarm latch ※1 | If it is an alarm condition, alarm output is ON and maintains ON status. |
| AL-C | Standby sequence1※2 | First alarm condition is ignored and from second alarm condition, standard alarm operates.<br>When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, standard alarm operates. |
| AL-d | Alarm latch and standby sequence1 | If it is an alarm condition, it operates both alarm latch and standby sequence. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, alarm latch operates. |
| AL-E | Standby sequence2 | First alarm condition is ignored and from second alarm condition, standard alarm operates.<br>When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON.<br>After clearing alarm condition, standard alarm operates. |
| AL-F | Alarm latch and standby sequence2 | Basic operation is same as alarm latch and standby sequence1. It operates not only by power ON/OFF,<br>but also alarm set value, or alarm option changing. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON.<br>After clearing alarm condition, alarm latch operates. |

- Condition of re-applied standby sequence for standby sequence 1, alarm latch and standby sequence 1: Power ON
- Condition of re-applied standby sequence for standby sequence 2, alarm latch and standby sequence 2: Power ON, changing set temperature, alarm temperature[AL 1, AL2, AL3] or alarm operation[AL-1, AL-2, AL-3], switching STOP mode to RUN mode.

| Parameter | Description |
|---|---|
| AL 1.t | Selects the operation mode of alarm output 1. |
| AL2.t | Selects the operation mode of alarm output 2. |
| AL3.t | Selects the operation mode of alarm output 3. |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr 4 | AL 1.t | AL-A / AL-b / AL-C / AL-d / AL-E / AL-F | AL-A | - |
| | AL2.t | | | |
| | AL3.t | | | |

Note

If alarm operation is set as loop break alarm [LbA], sensor break alarm [SbA], or heater break alarm[HbA], only standard alarm [AL-A] and alarm latch [AL-C] of alarm option are displayed.

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### 6.4.3 Alarm SV settings [PAr 1 → AL 1.L /AL 1.H /AL 2.L /AL 2.H /AL 3.L /AL 3.H]

You can set alarm output activation values. According to the selected alarm operation, configuration parameters [AL □.H /AL □.L ] will be activated for each setting.

| Parameter | Description |
|---|---|
| AL 1.L | Low limit value of alarm output 1. Reference value for determining heater burnout. |
| AL 1.H | High-limit value of alarm output 1. |
| AL 2.L | Low limit value of alarm output 2. Reference value for determining heater burnout. |
| AL 2.H | High-limit value of alarm output 2. |
| AL 3.L | Low limit value of alarm output 3. Reference value for determining heater burnout. |
| AL 3.H | High-limit value of alarm output 3. |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr 1 | AL 1.H<br>AL 2.H<br>AL 3.H<br>AL 1.L<br>AL 2.L<br>AL 3.L | · (temperature) High/Low-limit deviation: By individual input specification -F.S. to F.S.<br>· (temperature) Alarm absolute value: By individual input specification within displayed range.<br>· (analog) High/Low-limit deviation: -1999 to 9999 Within -F.S. to F.S.<br>· (analog) Alarm absolute value: By individual input specification within displayed range. | Temperature : 1550<br>Analog : 100.0 | - |

Note

Changing the alarm operation or options resets the settings to the highest or lowest values that will not trigger output in the new mode.

### 6.4.4 Alarm output hysteresis [PAr 4 → A 1.HY /A2.HY /A3.HY]

"6.4.1 Alarm operation [PAr 4 → AL - 1/AL - 2/AL - 3]. "H" from alarm operation represents the alarm output hysteresis. It is used to set an interval between alarm outputs ON/OFF periods.

Hysteresis can be set for individual alarm outputs (Alarm 1 Hysteresis/Alarm2 Hysteresis).

| Parameter | Description |
|---|---|
| A 1.HY | Sets the ON/OFF interval for alarm output 1. |
| A2.HY | Sets the ON/OFF interval for alarm output 2. |
| A3.HY | Sets the ON/OFF interval for alarm output 3. |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr 4 | A 1.HY<br>A2.HY<br>A3.HY | Temperature H, Analog: 001 to 100<br>Temperature L: 000.1 to 100.0 | 001 | Temperature: ℃/℉,<br>Analog: Digit |


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Note

Alarm output hysteresis applies to heater burnout alarm [HbA] in the same manner.

This parameter does not appear if Loop Break Alarm [LbA] or Sensor Break Alarm [SbA] is selected.

## 6.4.5 Alarm N.O./N.C. [PAr4 → A1.n/A2.n/A3.n]

You can set the relay contact method in the event of an alarm output.

| Setting | Description |
|---|---|
| no | Normally open<br>Stays open when normal and closes in the event of an alarm. |
| nC | Normally closed<br>Stays closed when normal and opens in the event of an alarm. |

| Parameter | Description |
|---|---|
| A1.n | Select contact type for alarm output 1. |
| A2.n | Select contact type for alarm output 2. |
| A3.n | Select contact type for alarm output 3. |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr4 | A1.n | no / nC | no | - |
| | A2.n | | | |
| | A3.n | | | |

Front LED Indicators

| Change | Alarm trigger | Alarm output | Front LED |
|---|---|---|---|
| no (normally open) | OFF | Open | • OFF |
| | ON | Close | • ON |
| nC (normally closed) | OFF | Close | • OFF |
| | ON | Open | • ON |

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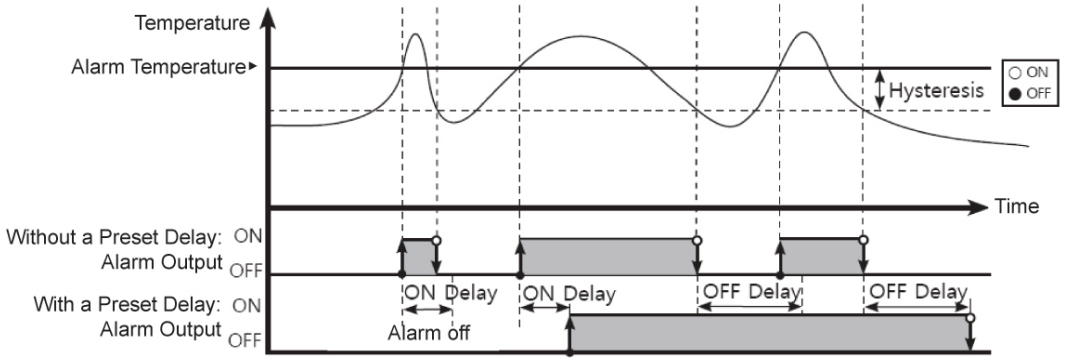
## 6.4.6 Alarm output delay settings [PAr4 → A1on / A1oF / A2on / A2oF / A3on / A3oF]

Alarm output delay can be set to prevent false alarms caused by erroneous input signals resulting from disturbances or noise.

With a preset delay time, alarm output does not turn on for the preset duration. Instead, the concerned alarm indicator on the front will flash in 0.5 sec. intervals.




| Parameter | Description |
|---|---|
| A1on | Alarm output 1 on delay: Stands by for the preset duration upon an alarm event, checks the alarm trigger conditions, and turns on the alarm output if the conditions are still present. |
| A1oF | Alarm output 1 off delay: Stands by for the preset duration following alarm output off, checks the alarm trigger conditions, and turns off the alarm output if the deactivation conditions are still present. |
| A2on | Alarm output 2 on delay: Stands by for the preset duration upon an alarm event, checks the alarm trigger conditions, and turns on the alarm output if the conditions are still present. |
| A2oF | Alarm output 2 off delay: Stands by for the preset duration following alarm output off, checks the alarm trigger conditions, and turns off the alarm output if the deactivation conditions are still present. |
| A3on | Alarm output 3 on delay: Stands by for the preset duration upon an alarm event, checks the alarm trigger conditions, and turns on the alarm output if the conditions are still present. |
| A3oF | Alarm output 3 off delay: Stands by for the preset duration following alarm output off, checks the alarm trigger conditions, and turns off the alarm output if the deactivation conditions are still present. |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr4 | A1on | 0000 to 3600 | 0000 | Sec. |
| | A1oF | | | |
| | A2on | | | |
| | A2oF | | | |
| | A2on | | | |
| | A2oF | | | |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## 6.4.7 Loop break alarm(LBA) [PAr 4 → AL - 1/AL-2/AL-3 → LbA]

Diagnoses the control loop by monitoring the control subject's temperature changes and sends out alarms if necessary.

- Heating control: When control output MV is 100% or high limit [H-ou] and PV is not increased over than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], or when control output MV is 0% or low limit [L-ou] and PV is not decreased below than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], alarm output turns ON.
- Cooling control: When control output MV is 0% or low limit [L-ou] and PV is not increased over than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], or when control output MV is 100% or high limit [H-ou] and PV is not decreased below than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], alarm output turns ON.

Common causes of LBA output ON

- Sensor error (disconnection, short)
- External controller error (magnet, auxiliary relay, etc.)
- External load error (heater, cooler, etc.)
- Misconnections and disconnections of external network.

If it is not as sensor break/HHHH/LLLL, during auto-tuning/manual control/control STOP/ramp function operation, loop break alarm does not operate.

| Type | LBA monitoring time | Alarm output | |
|---|---|---|---|
| | | Standard alarm | Alarm latch |
| Initializing Alarm, changing control output operation mode, setting LBA monitoring time/band as 0 | Initialize | OFF | OFF |
| Changing input correction value, set value | | Maintains the present alarm | Maintains the present alarm |
| Changing MV, stopping control, running auto-tuning | | OFF | Maintains the present alarm |
| Occurring sensor break alarm, HHHH, LLLL | | ON | ON |

### Note

Set alarm operation[AL - □] as loop break alarm [LbA] and you can use loop break alarm.

When executing auto-tuning, LBA detection band [LbA.b] and LBA monitoring time[LbA.t] is automatically set based on auto-tuning value.

In case of AT (auto-tuning)/manual control/stop control, loop break alarm [LbA] does not operates. When alarm reset is input, it initializes LBA monitoring start time.

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### 6.4.7.1 LBA monitoring time [PAr 4 → LbAt]

You can set the LBA monitoring time to check changes in the control subject's temperature. Automatically setting with auto-tunning.

- Regardless of alarm operation [AL - □] (including LBA monitoring time as “0”), after running auto-tuning, the integration time×2 value is saved automatically.
  (If SV is out of the range of auto setting, it is set as max. or min. value of auto setting.)
- Except input type changing, re-running auto-tuning, manual setting of LBA monitoring time, it maintains the present SV.
- Auto setting range: 0020 to 9999

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr 4 | LbAt | 0000 to 9999 | 0000 | Sec |

### 6.4.7.2 LBA detection band [PAr 4 → LbAb]

You can set the minimum value of deviation change to decrease during LBA monitoring time. Automatically setting with auto-tunning.

- Except input type changing, re-running auto-tuning, manual setting of LBA monitoring time, it maintains the present SV.
- Regardless of alarm operation [AL - □] (including LBA monitoring time as “0”), after running auto-tuning, the integration time×2 value is saved automatically.
  (If SV is out of the range of auto setting, it is set as max. or min. value of auto setting.)
- Auto setting range
  Temperature L: 002.0 to 100.0 (unit: ℃/℉)
  Temperature H: 0002 to 0 10.0 (unit: ℃/℉)
  Analog: 000.2 to 0 10.0 (unit: %F.S.)

| Setting group | Parameter | Setting range | | Factory default | Unit |
|---|---|---|---|---|---|
| PAr 4 | LbAb | Temperature H | 000 to 999 | 002 | ℃/℉ |
| | | Temperature L | 000.0 to 999.9 | 002.0 | ℃/℉ |
| | | Analog | 00.00 to 100.0 | 000.2 | %F.S. |


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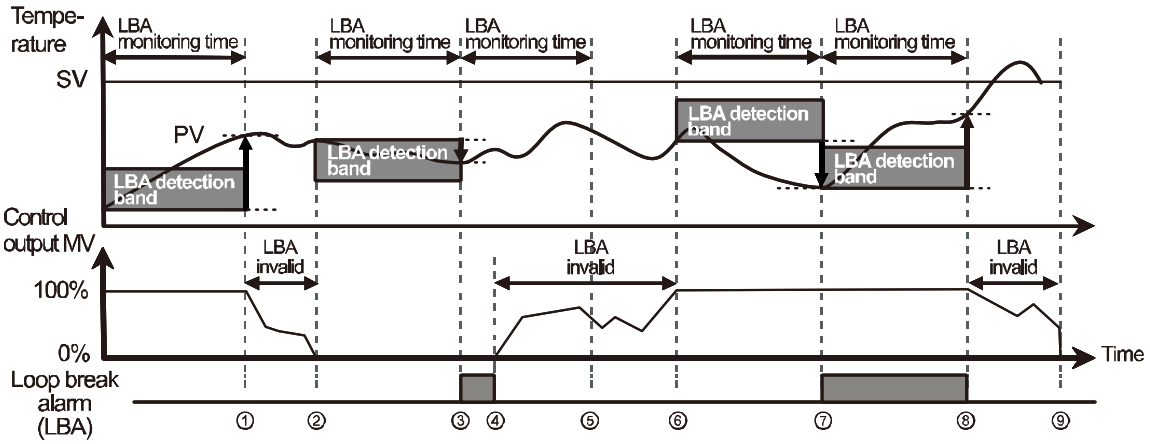
Ex.

It checks control loop and outputs alarm by temperature change of the subject.

For heating control(cooling control), when control output MV is 100%(0% for cooling control) and PV is not increased over than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], or when control output MV is 0%(100% for cooling control) and PV is not decreased below than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], alarm output turns ON.




| | |
|---|---|
| Start to ① | When control output MV is 100%, PV is increased over than LBA detection band [LbA.b] during LBA monitoring time [LbA.t]. |
| ① to ② | The status of changing control output MV (LBA monitoring time is reset.) |
| ② to ③ | When control output MV is 0% and PV is not decreased below than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], loop break alarm (LBA) turns ON after LBA monitoring time [LbA.t]. |
| ③ to ④ | Control output MV is 0% and loop break alarm (LBA) turns and maintains ON. |
| ④ to ⑥ | The status of changing control output MV (LBA monitoring time is reset.) |
| ⑥ to ⑦ | When control output MV is 100% and PV is not increased over than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], loop break alarm (LBA) turns ON after LBA monitoring time [LbA.t]. |
| ⑦ to ⑧ | When control output MV is 100% and PV is increased over than LBA detection band [LbA.b] during LBA monitoring time [LbA.t], loop break alarm (LBA) turns OFF after LBA monitoring time [LbA.t]. |
| ⑧ to ⑨ | The status of changing control output MV (LBA monitoring time is reset.) |

## 6.4.8 Sensor break alarm [PAr4 → AL-1/AL-2/AL-3 → SbA]

You can set the controller to send out an alarm when a sensor is not connected or disconnected during temperature control.

Sensor break can be confirmed through an external alarm output contact, such as a buzzer or similar means.

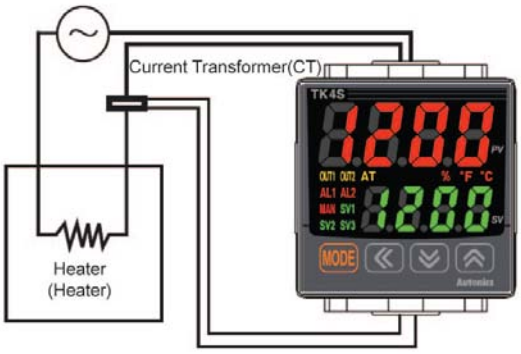
Setting alarm operation [AL-□] to SbA will activate Sensor Break Alarm.

Note

Alarm output option can be set to standard alarm [AL-A] or alarm latch [AL-b].

## 6.4.9 Heater burnout alarm [PAr 4 → AL - 1/AL -2/AL -3 → HbA]

- When using a heater to raise the temperature of the control subject, the temperature controller can be set to detect heater disconnection and send out an alarm by monitoring power supply to the heater.
- Heater disconnection is detected by the controller using a current transformer (CT), which converts the current to the heater to a specific ratio (CT ratio) for monitoring. If the heater current value [CT-A] measured by the CT is less than the heater detection set value [AL □.L], the heater burnout alarm will activate.




**Note**

- Heater burnout detection only takes place when the temperature controller's output is turned on. Otherwise, heater burnout will not be detected by the controller.
- Detection is only available in models with switching output (Relay output, SSR drive output). Models with linear output (current, SSR drive cycle/phase output) are incapable of detection.
- Current detection is not performed if OUT1's control output time is less than 250ms.
- It is recommended to use Autonics designated current transformer (for 50A).
- Alarm output option can be set to standard alarm [AL-A] or alarm latch [AL-b].
- In the case of TK4SP models, heater burnout alarm [HbA] mode is not available.

### 6.4.9.1 Heater burnout detection settings [PAr 1 → AL 1L / AL 2L / AL 3L]

Set the alarm output value [AL □.L] as the reference value for heater burnout detection.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr 1 | AL 1L | 00.0 to 50.0 | 00.0 | A |
| | AL 2L | | | |
| | AL 3L | | | |

**Note**

Set to 00.0 for OFF. Set to 50.0 for ON.

**Ex.**

Setting Value Calculation

: Heater Burnout Setting Value = {(Normal Heater Current) + (Heater Burnout Current)}/2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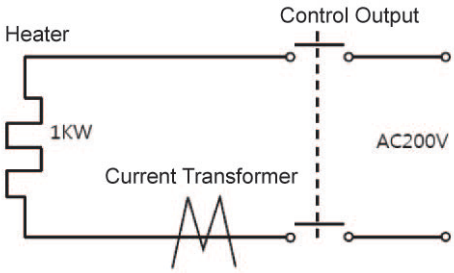
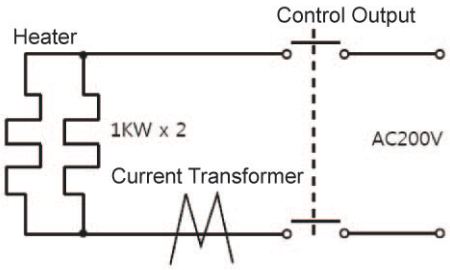



If using a single output heater (Capacity: 200VAC, 1KW, 5A), normal heater current is 5A, and burnout heater current is 0A, the set value is calculated as (5A + 0A)/2 = 2.5A. Therefore, heater current values less than 2.5A will be deemed heater burnout and the alarm will activate.




When two output heaters (Capacity: 200VAC, 1KW, 5A) are used, normal heater current is 10A (5A X 2EA). If a single heater burns out, the heater current becomes 5A. The set value is calculated as (10A + 5A)/2 = 7.5A). Heater current values of less than 7.5A are deemed heater burnout and the alarm activates.

## 6.4.10 Alarm output deactivation [PRr5 → dI -Y → RLrE]

Available only if alarm output option is set to alarm latch or alarm latch and standby sequence1, alarm latch and standby sequence2. It can be set to turn OFF alarm output when alarm output is ON, alarm output conditions have been removed, or an alarm output deactivation signal that is greater than the minimal signal band is received. (However, alarm output deactivation is unavailable when alarm conditions remain in effect.)

You can assign the front panel's digital input key or the digital input terminals (DI-1, DI-2) for the alarm output deactivation feature.(regardless of parameter mask)

### (1) Deactivating alarm output using digital input key

If the digital input key has been assigned for alarm output deactivation and the alarm output option is set to alarm latch or alarm latch and standby sequence, press and hold the front panel's ⊻⊼ keys when alarm output is on.

Note

For detailed information on digital input key settings, see 6.7.4.2 Digital input key.

### (2) Deactivation of alarm output using digital input (DI) terminal

When the digital input (DI) terminal is assigned to alarm (output) OFF, the alarm output will deactivate when digital input (DI) terminal goes into the on state (close). (the MAN indicator turns ON).

Note

For detailed information on digital Input (DI) key configuration, see '6.7.4.2 Digital input key'. For detailed information on digital Input (DI) terminal configuration, see '6.7.4.1 Digital input terminal settings [PRr5 → dI - 1/dI - 2]'.

After deactivating the alarm output, it will function normally for the next alarm output occurrence.

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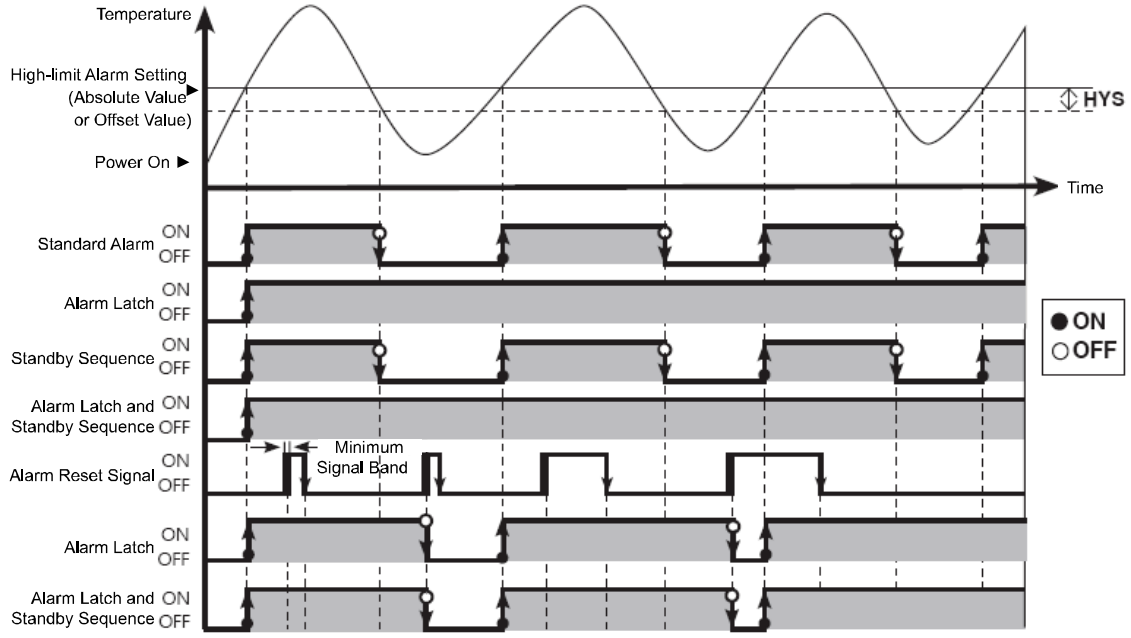
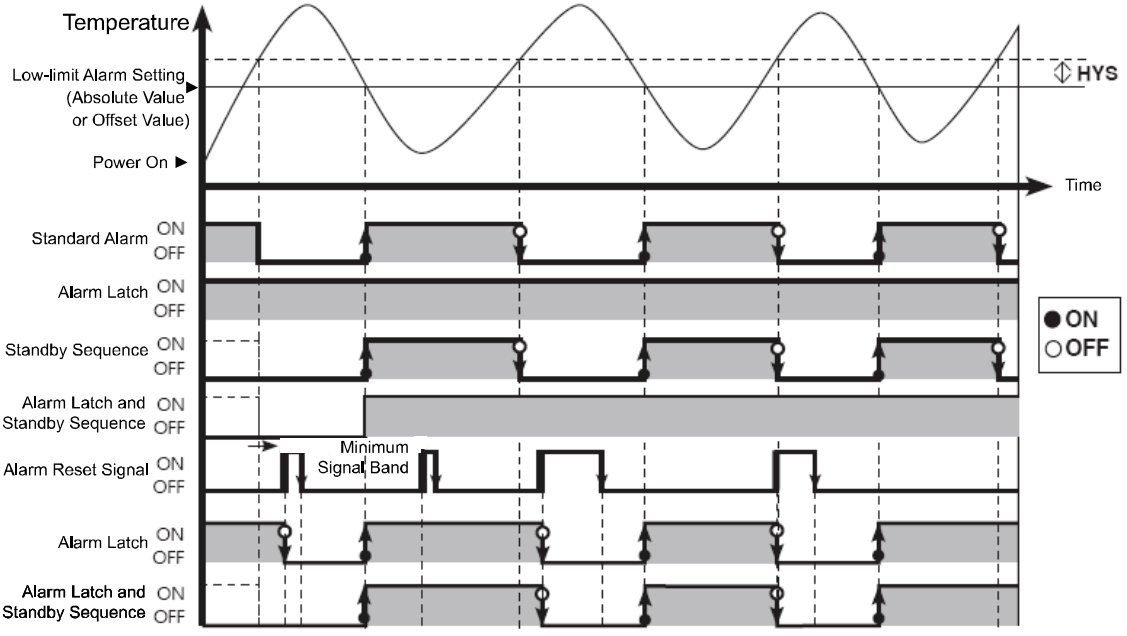
## 6.4.11 Alarm output examples

### 6.4.11.1 Absolute value high-limit alarm and deviation high-limit alarm




### 6.4.11.2 Absolute value low-limit alarm and deviation low-limit alarm





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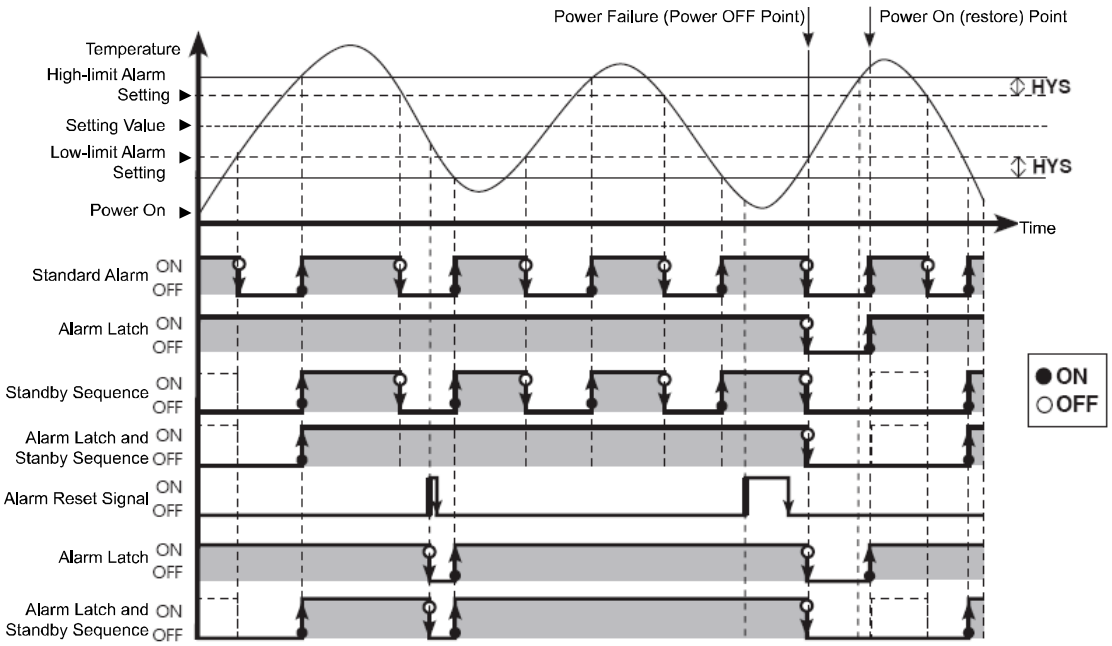
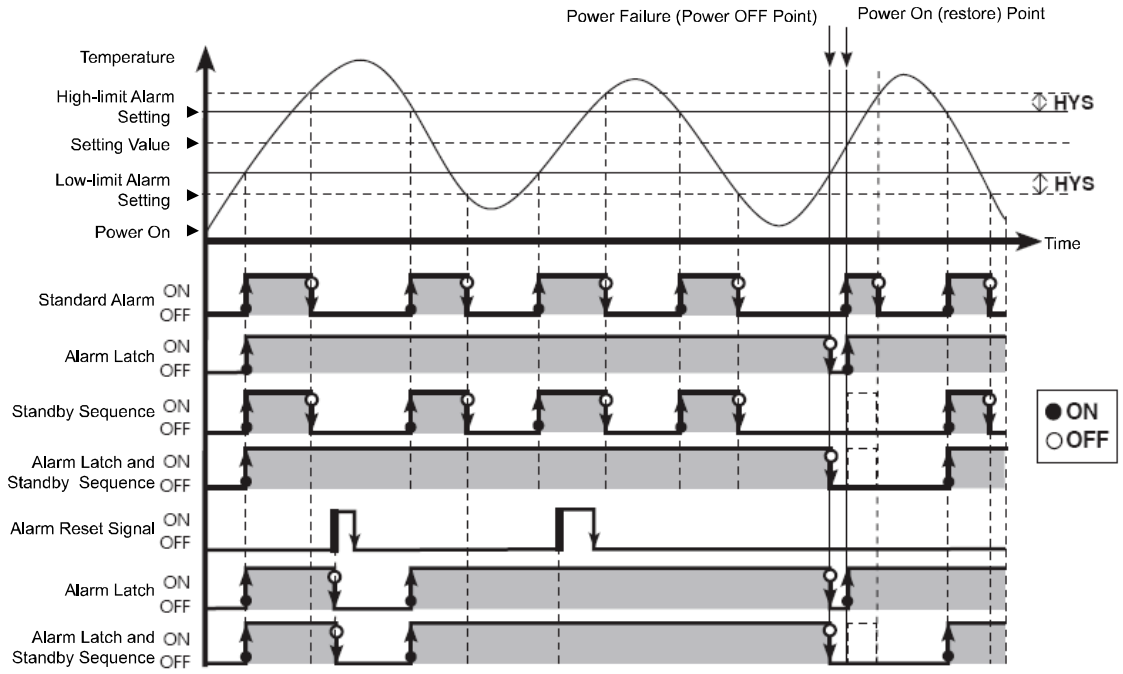
### 6.4.11.3 Deviation high/low-limit alarm




### 6.4.11.4 Deviation high/low-limit reverse alarm

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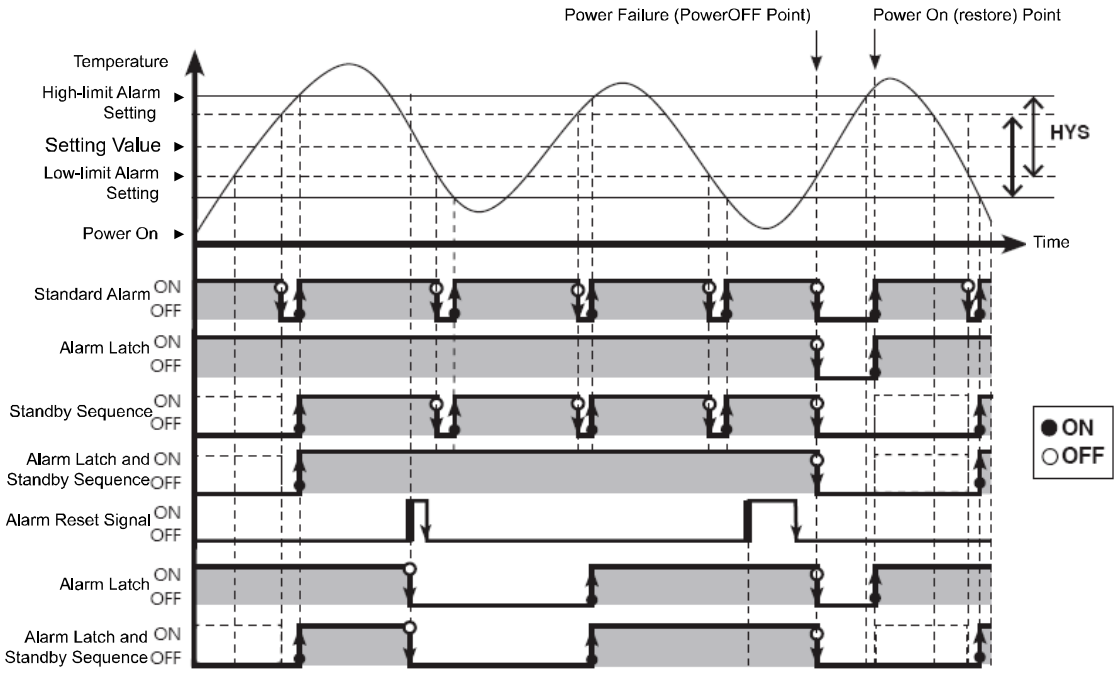
### 6.4.11.5 Deviation high/low-limit alarm (hysteresis overlap)





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# 6.5 Analog transmission

## 6.5.1 Analog transmission output value settings [PAr 4 → Ao.n 1 / Ao.n2]

Transmission output is a type of auxiliary output that converts the controller's present value, set value, heating MV, cooling MV to analog current (DC 4 to 20mA) for external transmission.

| Setting | Description |
|---|---|
| Pu | PV transmission output |
| Su | SV transmission output |
| H-ou | Heating MV transmission output |
| C-ou | Cooling MV transmission output |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr 4 | Ao.n 1<br>Ao.n2 | Pu / Su / H-ou / C-ou | Pu | - |

**Note**

When using standard control mode of OUT2 current output model , OUT2 current output is available as transmission output 2. For transmission output model, [Ao.n 1] is activated. For standard control mode of OUT2 current output model, [Ao.n2] is activated.

This parameter is activated in transmission output models only. Transmission output is constant current output. Too great a resistance from the load can cause the output value to change.There is no optional output below 4mA or above 20mA.

## 6.5.2 Transmission output high/low-limit value settings [PAr 4 → FS.L 1 / FS.H 1 → FS.L 2 / FS.H2]

If the transmission output value [Ao.n □] is below the transmission output low-limit [FS.L □], 4mA output will be provided. If the transmission output is between the low-limit [FS.L □] and high-limit [FS.H □], a certain proportional output within the range 4mA and 20mA will be provided. If it is above the high-limit [FS.H □], 20mA output will be provided.

| Setting | Description |
|---|---|
| FS.L 1<br>FS.L 2 | Sets the low-limit of transmission output (4mA). |
| FS.H 1<br>FS.H2 | Sets the high-limit of transmission output (20mA). |

| Setting group | Parameter | Setting range | | Factory default | Unit |
|---|---|---|---|---|---|
| PAr 4 | FS.L 1<br>FS.L 2 | Pu | Temperature: usage range<br>Analog: high/low scale range | -200 | digit |
| | | Su | SV low-limit value [L-Su] to<br>SV high-limit value [H-Su] | | |
| | | H-ou /C-ou | 000.0 to 100.0 | | |
| | FS.H 1<br>FS.H2 | Pu | Temperature: usage range<br>Analog: high/low scale range | 1350 | |
| | | Su | SV low-limit value [L-Su] to<br>SV high-limit value [H-Su] | | |
| | | H-ou / C-ou | 000.0 to 100.0 | | |

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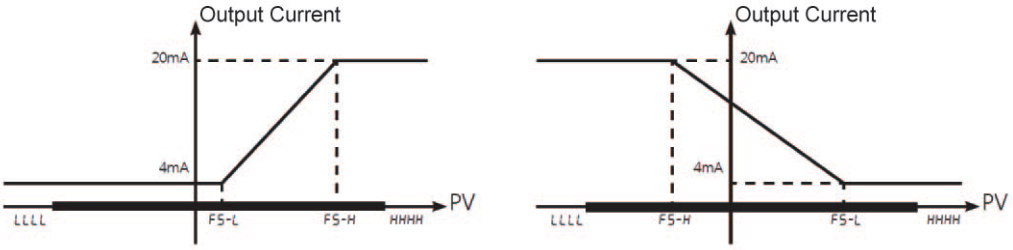
## Note

If transmission output high-limit [F5.H □] is transmission output low-limit [F5.L □], the transmission output is 4 mA.

### (1) Present value (PV) transmission output

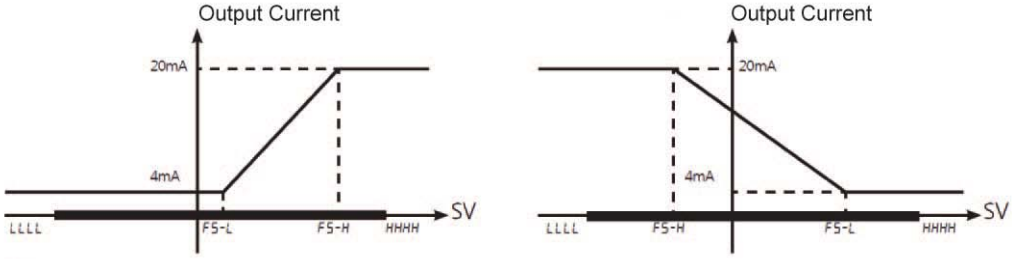
PV within sensor range or upper/low-limit scale can be converted and transmitted as current within the range of 4 to 20 mA.




※ ▬▬ : Sensor Range or High/Low-limit Scale

### (2) Set value (SV) transmission output

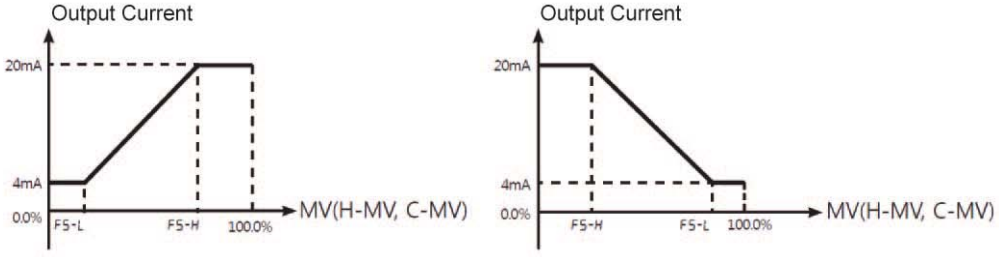
SV within sensor range or upper/low-limit scale can be converted and transmitted as current within the range of 4 to 20 mA. When ramp is in effect, ramp SV is transmitted step by step.




※ ▬▬ : SV Range (SV Low-limit to SV High-limit)

### (3) Heating MV/Cooling MV transmission output

You can convert 0 to 100% of heating [H-mv]/cooling MV [C-mv] into 4 to 20 mA current.





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## 6.6 Communication settings

This feature is used for external higher systems (PC, GP, etc.) to set the controller's parameters and to monitor the controller. It can also be used to transmit data to external devices.

No redundant unit addresses may exist along the same communication line. The communication cable must be a twist pair that supports RS485.

- Interface

| Category | Description |
|---|---|
| Standards | EIA RS485-compliant |
| Max. Connections | 31 units (Addresses: 01 through 99) |
| Communication | Two-wire, half duplex |
| Synchronization | Asynchronous |
| Valid Communication Distance | Max. 800 m |
| BPS (bits per second) | 2400, 4800, 9600, 19200, 38400 bps |
| Response Standby | 5 ms to 99 ms |
| Communication Start Bit | 1 bit (fixed) |
| Data Bit | 8 bit (fixed) |
| Communication Parity Bit | None, Even, Odd |
| Communication Stop Bit | 1, 2 bit |
| Protocol | Modbus Remote Terminal Unit (Character = 11 bit as fixed) |

**Note**

You could modify the parameter (first in, first out) using keys during communication connection, but this may lead to errors and malfunctions.

### 6.6.1 Unit address settings [PAr4 → Adr5]

You can assign individual addresses to data units.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr4 | Adr5 | 01 to 99 | 01 | - |

### 6.6.2 BPS (bits per second) settings [PAr4 → bPS]

You can set the rate of data transmission.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr4 | bPS | 24 (2400 bps) / 48 (4800 bps) / 96 (9600 bps) / 192 (19200 bps) / 384 (38400 bps) | 96 | bps |

### 6.6.3 Communication parity bit [PAr4 → PrtY]

Parity bit is a data communication method that adds an additional bit to each character in transmitted data as an indicator used to verify data loss and corruption. This parameter is used to enable or disable the parity bit option.

| Setting | Description |
|---|---|
| nonE | Disables parity bit. |
| EuEn | Sets the total bits with signal value of 1 as even numbers. |
| odd | Sets the total bits with signal value of 1 as odd numbers. |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr4 | PrtY | nonE / EuEn / odd | nonE | - |

### 6.6.4 Communication stop bit settings [PAr4 → StP]

You can set the number of bits to mark the end of a transmitted data string.

| Setting | Description |
|---|---|
| 1 | Sets end of data string to 1 bit. |
| 2 | Sets end of data string to 2 bits. |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr4 | StP | 1 / 2 | 2 | bit |

### 6.6.5 Response wait time settings [PAr4→ rSUt]

Set a standby time to mitigate communication errors when communicating with a slow master device (PC, PLC, etc.). Once a standby time is set, the controller will respond after the defined standby time.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr4 | rSUt | 05 to 99 | 20 | ms |

**Note**

Shorter standby times can cause communication errors in the master device.


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### 6.6.6 Enable/Disable communication write[PAr4→CoMY]

This feature can change parameter settings stored in memory through communication with PC, GP, PLC, etc., in order to permit or prohibit writing.

| Setting | Description |
|---|---|
| EnA | Parameter set/change enable via communication. |
| diS A | Prohibit parameter setting or modification via communication. |

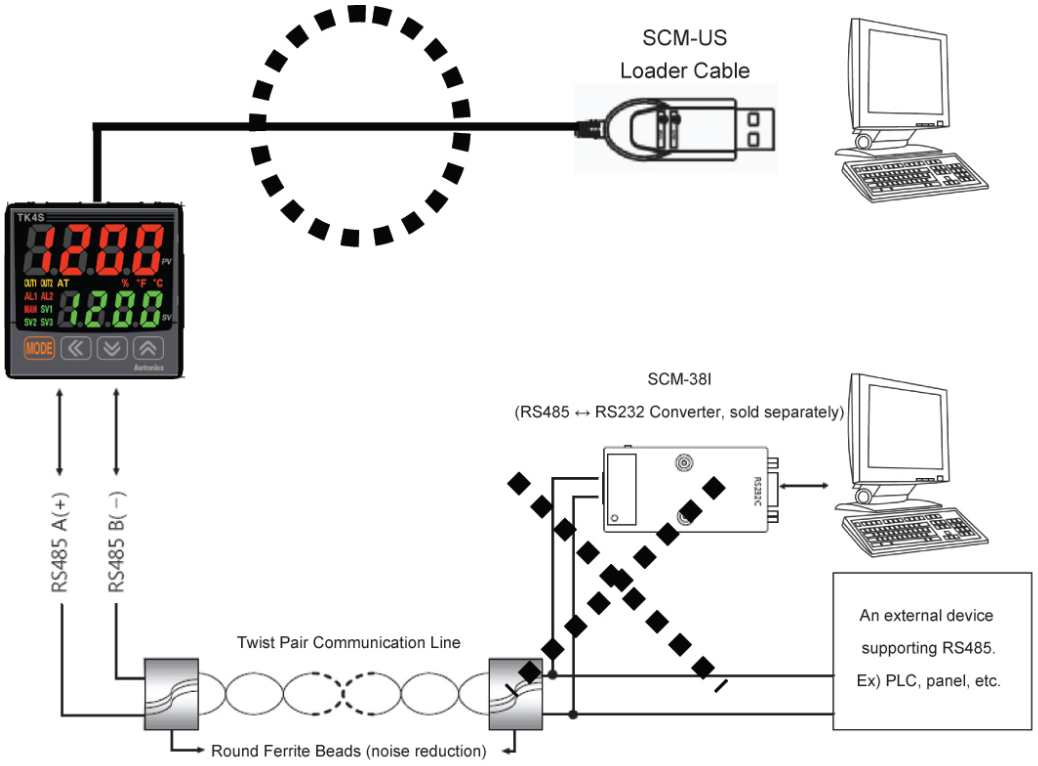
| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr4 | CoMY | EnA / diS A | EnA | - |

**Note**

Reading parameter settings is available even though prohinit parameter setting.

### 6.6.7 USB to Serial communication connection

Data can be transmitted via a USB-to-serial connection. However, RS485 communication through a USB-to-serial connection is blocked by hardware.



# 6.7 Additional features

## 6.7.1 Monitoring

Refer to '5.2.3 MV monitoring and manual control'.

### 6.7.1.1 Control output MV monitoring

Monitors and displays the current control output MV.

#### 6.7.1.1.1. Heating MV monitoring

Displays the current heating MV during heating control or heating & cooling control.Users may manually adjust the MV to control the temperature.

- Measurement range: H 0.0 to H 100 (Unit: %)

Note

Capable of displaying MV with a moving decimal point (H99.9 → H 100).

#### 6.7.1.1.2. Cooling MV monitoring

Displays the current cooling MV during cooling control or heating & cooling control.Users may manually adjust the MV to control the temperature.

- Measurement Range: C 0.0 to C 100 (Unit: %)

Note

Capable of displaying MV with a moving decimal point (C99.9 → C 100).

### 6.7.1.2 Heater current monitoring [PAr 1 → Ct-A]

A feature that monitors and displays the current of a heater (load) being controlled by control output.

| Setting Group | Parameter | Measurement range | Unit |
|---|---|---|---|
| PAr 1 | Ct-A | 0.0 to 50.0 | A |

Note

A current transformer (CT) is used to measure and display the heater's (load) current.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## 6.7.2 RUN/STOP [PAr 1 → r-S]

Users may run or stop control output by force while in RUN mode.

The stop command stops control output. Auxiliary output, however, is not affected by the command. This feature can be enabled by configuring parameters. In addition, the front panel's digital input keys ( for 3 sec.) and digital input terminals (DI-1 and DI-2) can be assigned to the run/stop feature. (regardless of parameter mask)

| Setting | Description |
|---|---|
| rUn | Forced control output run in STOP mode. |
| StoP | Forced control output stop in RUN mode. |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr 1 | r-S | rUn / StoP | rUn | - |

### Note

With stop enabled, the front panel's SV display indicates StoP.

You can change the setting when in the stop state. The stop status will remain in effect after shutting down the controller and powering it back on.

When stop is in effect, STOP MV[St.mu] will be output. In case of a sensor break occurring while in STOP, STOP MV[St.mu] is output.

The run/stop setting remains in effect after turning power back on.

If the digital Input (DI-1, DI-2) feature has been set for RUN/STOP, RUN/STOP feature by modifying front keys or parameter is unable.

### 6.7.2.1 Stop control output settings [PAr S → St.mu]

This parameter sets the control output value when in the stop state. With ON/OFF control, select between 100.0 (ON) and 000.0 (OFF). With PID control, the user can adjust the MV between 000.0 and 100.0.

| Setting group | Parameter | Setting range | | | Factory default | Unit |
|---|---|---|---|---|---|---|
| PAr S | St.mu | Standard Control | ON/OFF Control | 000.0 (OFF) / 100.0 (ON) | 000.0 | % |
| | | | PID Control | 000.0 to 100.0 | 000.0 | |
| | | Heating & cooling Control | ON/OFF Control | -100.0 (Cooling ON) / 000.0 (OFF) / 100.0 (Heating ON) | 000.0 | |
| | | | PID Control | -100.0 (Cooling) to 100.0 (Heating) | 000.0 | |

### Note

Ignores MV from ON/OFF control or PID control and sends out a control value based on the defined MV.

#### 6.7.2.2 Stop alarm output [PAr5 → St.AL]

Enable or disable alarm output upon a stop.

| Setting | Description |
|---|---|
| oFF | Alarm output ceases along with a stop under all conditions.<br>(However, reverting to RUN mode after a stop in alarm latch or alarm latch and standby sequence restores the alarm output to the previous state.) |
| Cont | Alarm output continues regardless of control operation. |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr 1 | r-5 | Cont / oFF | Cont | - |

### 6.7.3 Multi SV

Multi SV function allows users to set multiple SVs and save each setting in SU0 to SU3. Users can change SU-n or select desired SV using external digital input terminal (digital input, DI-1, DI-2) function.

This feature supports up to four SVs which can be independently configurable.

#### 6.7.3.1 Number of Multi SVs [PAr5 → nt.SU]

This parameter sets the number of Multi SVs. Select the number of Multi SVs required by the control subject.

| Number of SVs | SV Assignment |
|---|---|
| 1 EA | SU-0 |
| 2 EA | SU-0, SU-1 |
| 4 EA | SU-0, SU-1, SU-2, SU-3 |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr5 | nt.SU | 1 / 2 / 4 | 1 | EA |

Note

If the digital Input (DI-1, DI-2) feature has been set for multi SV [nt.SU], the number of Multi SV is not modified through pressing key or communication.(regardless of parameter mask)

#### 6.7.3.2 Multi SV No. selection [PAr 1 → SU-n]

Select the SV to control.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr 1 | SU-n | SU-0 / SU-1 / SU-2 / SU-3 | SU-0 | - |

Note

The range of figures assigned to each SV (SV No.) varies depending on the number of Multi SVs [nt.SU] setting.


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#### 6.7.3.3 Multi SV settings [PAr 1 → Su-0/Su-1/Su-2/Su-3]

Designate the value of each SV for Multi SVs.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr 1 | Su-0 | Setting value low-limit [L-Su] to Setting value high-limit [H-Su] | 0 | ℃,℉,- |
| | Su-1 | | | |
| | Su-2 | | | |
| | Su-3 | | | |

## 6.7.4 Digital input

#### 6.7.4.1 Digital input terminal settings [PArS → dI-1/dI-2]

By connecting an external input to a digital input terminal, you can perform preset digital input terminal functions.

| Setting | Description |
|---|---|
| oFF | No function |
| StoP | Run/Stop |
| AL.rE | Alarm output deactivation |
| mAn | Auto/manual control selection |
| At | Auto-tuning start |
| mt.Su | Multi SV selection |

In the case one of DI-1 or DI-2 being set for Multi SV[mt.Su], Su-0 is selected as the SV if the terminal's external contact signal is off and Su-1 is selected if the signal is on.

If both DI-1 and DI-2 are configured for Multi SV[mt.Su], you can select the SV using combinational logic of the terminals. If multi SV [mt.Su] are changed from 4 to 2, DI-2 will be turned OFF automatically, changed from 4 to 1, both DI-1 and DI-2 will be turned OFF or changed from 2 to 1, concerned DI will be OFF.

| DI-1 | DI-2 | Multi SV No. |
|---|---|---|
| OFF | OFF | Su-0 |
| ON | OFF | Su-1 |
| OFF | ON | Su-2 |
| ON | ON | Su-3 |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PArS | dI-1 | oFF / StoP / AL.rE / mAn / mt.Su | oFF | - |
| | dI-2 | | | |

### Note

When powered on, the digital input feature checks always the settings of terminal input.

Multi SV parameter will be activated only if Multi SV is more than 2.

The TK4SP Series has a limited number of terminal blocks and does not feature a digital input terminal. Therefore, the digital input terminal functions are not available.

TheTK4S, M Series has a limited number of terminal blocks. Therefore, the digital input terminal1 (DI-1) is available. (In case of TK4S-D4 □□, only DI-1, DI-2 are available)

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Digital input terminal function operates irrespective of 6.7.7 Lock , 6.7.9 Password settings [PAr5 → PUd], 8.3.1 Parameter mask.

### 6.7.4.2 Digital input key

With digital input key enabled in RUN mode, press and hold ⮟⮝ keys at the same time for 3 sec. to activate the preset function.

#### 6.7.4.2.1. Digital input key settings [PAr5 → dI -U]

In order to use the digital input key feature, each function has to be first assigned to the keys.

| Setting | Description |
|---|---|
| StoP | RUN/STOP |
| AL.rE | Forced alarm output deactivation |
| At | Auto-tuning RUN/OFF(in case of control method is PID control) |
| oFF | Not using digital input key |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr5 | dI -U | StoP / AL.rE | StoP | - |

Note

If the digital input key and the digital input terminal set equally, the digital input key does not act.

#### 6.7.4.2.2. Digital input key use

Press the digital input keys on the front panel to execute the function assigned to the keys.

When in RUN mode, press and hold ⮟+⮝ keys for 3 sec. to execute the assigned function (run/stop or alarm output deactivation).

Note

If the same function is assigned to a digital input key and the digital input terminal, activation takes place as an "or" function and deactivation as an "and" function. (However, this does not apply to the Multi SV feature of digital input terminals.)

Digital input key functions operate irrespective of 6.7.9 Password settings [PAr5 → PUd], 8.3.1 Parameter mask.


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## 6.7.5 Error

The controller diagnoses input signals for errors and displays messages accordingly. These messages inform the user of device problems.

| Message | Input | Description | Output |
|---|---|---|---|
| HHHH | Temperature sensor | Flashes at 0.5 sec. intervals if the input value is above the input range. | Standard type:<br>Heating: 0%, Cooling: 100%<br>Heating&Cooling:<br>Heating: 0%, Cooling: 100% |
| | Analog | Flashes at 0.5 sec. intervals if the input value is over 5 to 10% of high limit or low limit value. | Normal output |
| LLLL | Temperature sensor | Flashes at 0.5 sec. intervals if the input value is below the input range. | Standard type:<br>Heating: 100%, Cooling: 0%<br>Heating&Cooling:<br>Heating: 100%, Cooling: 0% |
| | Analog | Flashes at 0.5 sec. intervals if the input value is over 5 to 10% of low limit or high limit value. | Normal output |
| oPEn | Temperature sensor | Flashes at 0.5 sec. intervals in the event of an input disconnection. | Outputs the set MV at Er.mu |
| | Analog | Flashes at 0.5 sec. intervals if F.S. is over ±10%. | |
| Err | Temperature sensor | Flashes at 0.5 sec. intervals if there is error for setting and it returns to the error-before screen. | - |

When input value returns to the input range, alarm is deactivated and it operates normally.

### Note

When in heating control mode and powered on, or standard control state, output is 0% if HHHH is displayed and 100% if LLLL is displayed.

When in cooling control and powered on (or standard control state), output is 100% if HHHH is displayed and 0% if LLLL is displayed.

When in heating & cooling control and powered on or standard control state, heating output is 0% and cooling output 100% if HHHH is displayed, and heating output is 100% and cooling output 0% if LLLL is displayed.

### 6.7.5.1 MV Settings upon sensor break error [oPEn](MV for Error) [PAr5 → Er.mu]

In the event of a sensor open error you can set control output value to predefined MV instead of ON/OFF control or PID control.

Ignores MV by ON/OFF control or PID control, and sends out a control value based on the defined MV.

| Setting group | Parameter | Setting range | | | Factory default | Unit |
|---|---|---|---|---|---|---|
| PAr5 | Er.mu | Standard Control | ON/OFF Control | 000.0 (OFF)/ 100.0 (ON) | 000.0 | % |
| | | | PID Control | 000.0 to 100.0 | | |
| | | Heating & cooling Control | ON/OFF Control | -100.0 (Cooling On)<br>/000.0 (OFF)/ 100.0 (Heating On) | | |
| | | | PID Control | -100.0 (Cooling) to 100.0 (Heating) | | |

## 6.7.6 User level setting [PAr5 → USEr]

You can restrict parameter display by setting user level (standard or high).

When you set as a standard level user, the main function parameters shaded on the entire parameter list(See the 5.3 Parameter group), are only displayed.

| Parameter | Parameter description |
|---|---|
| Stnd | Activates standard user parameters |
| HI GH | Activates all parameters |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr5 | USEr | Stnd / HI GH | Stnd | - |

## 6.7.7 Lock settings

### 6.7.7.1 SV group lock [PAr5 → LC.Su]

You can restrict SV parameter modification by locking SV group parameters, which include SV selection, digital input key (▼▲ keys for 3 sec.), A/M (the MODE key for TK4N, TK4S, TK4SP model) key for monitoring and manual control, parameter reset [Init], etc.

| Setting | Function |
|---|---|
| on | Activates SV group lock. |
| oFF | Deactivates SV group lock. |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr5 | LC.Su | on / oFF | oFF | - |

### 6.7.7.2 Parameter group lock [PAr5 → LC.P1/LC.P2/LC.P3/LC.P4/LC.P5]

Lock or unlock individual parameter groups from parameter 1 group [PAr1] to parameter 5 group [PAr5].

Even with parameter group lock in place, you can still read parameter settings.
In Parameter 5's [PAr5] case, the settings can still be modified even with a lock [LC.Su/LC.P□] initiated.

| Parameter | Parameter description |
|---|---|
| on | Lock parameter group |
| oFF | Unlock parameter group |

| Parameter | Parameter description |
|---|---|
| LC.P1 | Lock parameter 1 group. |
| LC.P2 | Lock parameter 2 group |
| LC.P3 | Lock parameter 3 group |
| LC.P4 | Lock parameter 4 group |
| LC.P5 | Lock parameter 5 group |

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PAr5 | LC.P1 to LC.P5 | on / oFF | oFF | - |


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### 6.7.8 Parameter initialization[Init]

This function is to reset all parameters in memory to factory defaults.

Press and hold the front panel's ◀ ▼ ▲ keys for 5 sec. The Init parameter will be displayed. Select YES to reset the parameters.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| - | Init | YES / no | no | - |

**Note**

If the password feature is activated, it is required to enter a password to activate this function. Resetting the parameters also resets the password.

If this parameter initialization[Init] is masked, it cannot be used.

### 6.7.9 Password settings [PArS → PUd]

Assigning password access to SV group features (excluding digital input key) and Parameter 1 through 5 prevents unauthorized modification to the parameter settings.

Password setting applies to SV group features (excluding digital input key) and Parameter 1 through 5 comprehensively.

Changing the password setting automatically activates password protection. Setting the password to 0000, however, disables password protection.

0001 is a read-only password. Under this setting, the user may check parameter settings without knowing the password. The user, however, cannot change parameter settings.

Accessing the PUd parameter with the read-only password displays a coded form of the setting.

- Settings

1st When in RUN mode, press and hold the MODE key.

2nd Use the ▼ ▲ keys to select PArS and then press the MODE key.

3rd Press the MODE key to search PUd.

4th Select the desired digit using the ◀ key.

5th Use the ▼ ▲ keys to set the password (0000, 0002 to 9999) then press the MODE key to set the password.

6th Repeat steps 4 and 5 and enter the preset password.

7th Press the MODE key or do not make any additional key entry for 3 sec. to save the password.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PArS | PUd | 0000 (password protection deactivated.)<br>0002 to 9999 (password protection on.) | 0000 | - |

**Note**

'6.7.4 Digital input' features are not affected by password protection settings.

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### 6.7.9.1 Password entry [PASS]

If password protection is turned on, accessing SV parameters or groups when the unit is in RUN mode will prompt a password confirmation parameter [PASS]. Then, the correct password has to be entered to access the setting parameters.

- Settings

  1st Access SV parameter or parameter group.

  2nd When prompted with PASS, use the ◁ key to select the desired digit.

  3rd Use the ▽△ keys to enter the password (0001 through 9999) and then press the MODE key.

- If the correct password is entered, you can access setting parameters.
- If an incorrect password is entered, repeat steps 2 and 3 and enter the correct password.

| Setting group | Parameter | Setting range | Factory default | Unit |
|---|---|---|---|---|
| PArS | PASS | 0001 (read-only), 0002 to 9999 | 0001 | - |

**Note**

If the password is unknown, enter 0001 to access the parameters in read-only mode.

This parameter only appears if the setting from 6.7.9 Password settings [PArS → PYd] is set to a value other than 0000.

If an incorrect password has been entered, the SV display section displays a coded form of the password stored by the user and an error message [Err]. Then, the error message flashes in 1 sec. intervals.

### 6.7.9.2 Password recovery

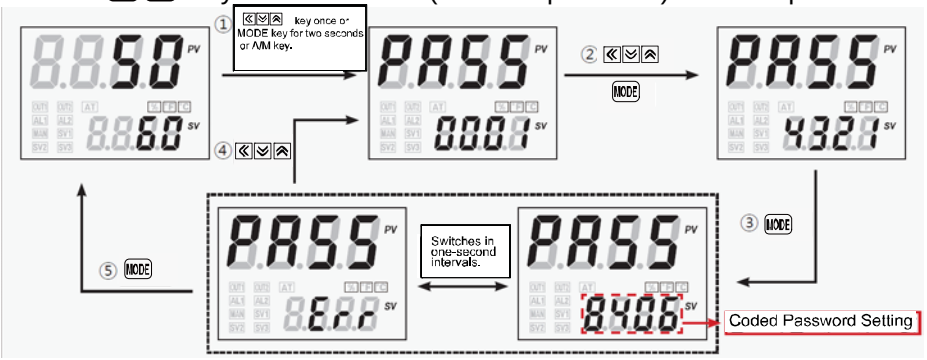
Entering an incorrect password displays a coded form of the password on the SV display. Submit this code to Autonics to recover your lost password.

Incorrect Password Entry (For example, the correct password being 1234)

1st Access SV parameter or parameter group.

2nd When prompted with PASS, use the ◁ key to select the desired digit.

Use the ▽△ keys to select 4321(incorrect password) and then press the MODE key.




Entering an incorrect password displays a coded password on the SV display. An Err message will also appear, flashing at 1 sec. intervals.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# 7 Setting group parameter description

## 7.1 Setting group [ SU ]

| Parameter | | Description | Set range | Unit | Factory default |
|---|---|---|---|---|---|
| SU | Set value | SV | Between L-SU and H-SU | ℃/℉/- | 0 |
| ▼▲ key | Digital input Key Execute | Digital input execution key | Press the ▼▲ keys more than 3 sec. | - | - |
| A/M key | Auto_Manual Monitoring/Control | MV monitoring/manual control execution key | Press the A/M key more than 1 sec. | - | - |
| InIt | Parameter initialize | Resets parameters to factory defaults | no / YES | - | no |

## 7.2 MV monitoring/manual control setting group [ MU ]

| Parameter | | Description | Set range | Unit | Factory default |
|---|---|---|---|---|---|
| H-MU | Heating_MV | Heating MV | H 0.0 to H 100 | % | - |
| C-MU | Cooling_MV | Cooling MV | C 0.0 to C 100 | % | - |

※It is possible to manually control and monitor heating & cooling MVs at the same time.

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## 7.3 Parameter 1 setting group [PAr 1]

| Parameter | | Description | Set range | Unit | Factory default |
|---|---|---|---|---|---|
| r-S | RUN_STOP | Control Output RUN/STOP | rUn / StoP | - | rUn |
| Su-n | Multi SV No. | Multi SV number selection | Su-0 / Su-1 / Su-2 / Su-3 | - | Su-0 |
| Ct-A | Heater current monitoring | Heater current monitoring | 0.0 to 50.0 (display range) | A | - |
| AL 1L | Alarm1_low | Alarm output 1's low-limit value | Offset Alarm: -F.S. to F.S.<br>Absolute Value Alarm: Within display range. | ℃/℉/- | 1550 |
| AL 1H | Alarm1_high | Alarm output 1's high-limit value | | | |
| AL2L | Alarm2_low | Alarm output 2's low-limit value | | | |
| AL2H | Alarm2_high | Alarm output 2's high-limit value. | | | |
| AL2L | Alarm3_low | Alarm output 3's low-limit value | | | |
| AL2H | Alarm3_high | Alarm output 3's high-limit value. | | | |
| Su-0 | SV-0 set value | SV-0 set value | Between L-Su and H-Su | ℃/℉/- | 0000 |
| Su-1 | SV-1 set value | SV-1 set value | Between L-Su and H-Su | ℃/℉/- | 0000 |
| Su-2 | SV-2 set value | SV-2 set value | Between L-Su and H-Su | ℃/℉/- | 0000 |
| Su-3 | SV-3 set value | SV-3 set value | Between L-Su and H-Su | ℃/℉/- | 0000 |


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## 7.4 Parameter 2 setting group [PAr2]

| Parameter | | Description | Set range | Unit | Factory default |
|---|---|---|---|---|---|
| At | Auto-tuning execute | Auto-tuning ON/OFF | oFF/on | - | oFF |
| H-P | Heating_ proportional band | Heating proportional band | 000.1 to 999.9 | ℃/℉/% | 010.0 |
| C-P | Cooling_ proportional band | Proportional band in cooling mode | | | |
| H-I | Heating_integral time | Heating integral time | 0000 to 9999 | Sec | 0000 |
| C-I | Cooling_integral time | Cooling integral time | | | |
| H-d | Heating_derivation time | Heating derivative time | 0000 to 9999 | Sec | 0000 |
| C-d | Cooling_derivation time | Cooling derivative time | | | |
| db | Dead_overlap band | Heating & cooling control dead band | P/P, P/ONOFF, and ONOFF/P Controls -Proportional Band to 0.0 to +Proportional Band (if different, based on whichever is lesser) ONOFF/ONOFF Control -999 to 0999 (Temperature H) -199.9 to 999.9 (Temperature L) | Digit | 0000 |
| | | | -99.9 to 099.9 (Analog) | %F.S. | 000.0 |
| rESt | Manual reset | Manual reset under proportional control | 000.0 to 100.0 | % | 050.0 |
| HHYS | Heating_ON hysteresis | Heating hysteresis | 001 to 100 (000.1 to 100.0) | Digit | 002 (002.0) |
| HoSt | Heating_OFF offset | Heating off point offset | 000 to 100 (000.0 to 100.0) | Digit | 000 |
| CHYS | Cooling_ON hysteresis | Cooling hysteresis | 001 to 100 (000.1 to 100.0) | Digit | 002 (002.0) |
| CoSt | Cooling_OFF offset | Cooling off point offset | 000 to 100 (000.0 to 100.0) | Digit | 000 |
| L-ou | MV low-limit | MV low-limit setting | 000.0 to H-ou-0.1 (standard control) -100.0 to 000.0 (heating & cooling control) | % | 000.0 (-100.0) |
| H-ou | MV high-limit | MV high-limit value | L-ou+0.1 to 100.0 (standard control) 000.0 to 100.0 | % | 100.0 (100.0) |

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| Parameter | | Description | Set range | Unit | Factory default |
|---|---|---|---|---|---|
| | | | (heating & cooling control) | | |
| rAnU | Ramp_up rate | Ramp rise rate | 000 to 999 (000.0 to 999.9) | Digit | 000 |
| rAnd | Ramp_down rate | Ramp down rate | 000 to 999 (000.0 to 999.9) | Digit | 000 |
| r.Unt | Ramp time unit | Ramp time unit | SEC / nIn / HoUr | - | nIn |


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## 7.5 Parameter 3 setting group [ PAr3 ]

| Parameter | | Description | Set range | | Unit | Factory default |
|---|---|---|---|---|---|---|
| In-t | Input type | Input type | See Input types chart. | | - | tCA.H |
| Unit | Unit | Sensor temperature unit | °C / °F | | - | °C |
| L-rG | Low input range | Analog low-limit input value | Minimum range. to H-rG - F.S.10% | | Digit | 00.00 |
| H-rG | High input range | Analog high-limit input value | L-rG+F.S.10% to Maximum range. | | Digit | 10.00 |
| dot | Scaling decimal point | Decimal point position - scale value | 0 / 0.0 / 0.00 / 0.000 | | - | 0.0 |
| L-SC | Low scaling | Scale low-limit display value | -1999 to 9999 | | - | 000.0 |
| H-SC | High scaling | Scale high-limit display value | -1999 to 9999 | | - | 100.0 |
| d.Unt | Display unit indicator | Front unit display | °C / °F / °r.o / oFF | | - | °r.o |
| In-b | Input correction | Input correction | -999 to 0999 (-199.9 to 999.9) | | Digit | 0000 |
| nAv.F | Input digital filter | Moving average digital filter | 000.1 to 120.0 | | Sec | 000.1 |
| L-Su | SV low-limit | SV low-limit value | Input Low-limit [L-SC] to H-Su-1digit | | ℃/℉/% | -200 |
| H-Su | SV high-limit | SV high-limit value | L-Su+1digit to input high-limit [H-SC] | | ℃/℉/% | 1350 |
| o-Ft | Control operating type | Control output operation mode | Standard | HEAt / CooL | - | HEAt |
| | | | Heating & Cooling type | HEAt / CooL / H-C | | H-C |
| C-nd | Control method | Temperature control type | Standard | PId / onoF | - | PId |
| | | | Heating & Cooling type | P.P / P.on / on.P / on.on | | P.P |
| At.t | Auto-tuning type | Auto-tuning mode | tUn1 / tUn2 | | - | tUn1 |
| oUt1 | Output1 (SSR_Curr) type | OUT1 control output type | SSr / CUrr | | - | CUrr |
| o1.Sr | OUT1 SSR function | OUT1 SSR drive output type | Stnd / CYCL / PHAS | | - | Stnd |
| o1.nA | OUT1 current range | OUT1 current output range | 4-20 / 0-20 | | - | 4-20 |
| oUt2 | Output2 (SSR_Curr) type | OUT2 control output type | SSr / CUrr | | - | CUrr |
| o2.nA | OUT2 current range | OUT2 current output range | 4-20 / 0-20 | | - | 4-20 |

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| Parameter | | Description | Set range | Unit | Factory default |
|---|---|---|---|---|---|
| H-t | Heating_control time | Heating control period | Relay output, SSR drive output(standard ON/OFF, phase, cycle control): 000.1 to 120.0<br>Current output, SSR drive output: 000.1 to 120.0 | Sec | 020.0 (Relay)<br>020.0 (SSR) |
| C-t | Cooling_control time | Cooling control period | | Sec | |


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## 7.6 Parameter 4 setting group [PAr4]

| Parameter | | Description | Set range | Unit | Factory default |
|---|---|---|---|---|---|
| AL-1 | Alarm1 mode | Alarm output 1 operation mode | oFF/ duCC/ ]]du/ ]duC CduC/ PuCC/ ]]Pu/ LbA SbA/ HbA | - | duCC |
| AL 1t | Alarm1 type | Alarm output 1 option/type | AL-A/ AL-b/ AL-C/ AL-d/ AL-E/ AL-F | - | AL-A |
| A 1HY | Alarm1 hysteresis | Alarm output 1 hysteresis | 001 to 100 (000.1 to 100.0) | Digit | 001 |
| A 1n | Alarm1 N.O./N.C. | Alarm output 1 N.O./N.C. | no/nC | - | no |
| A 1on | Alarm1 ON delay time | Alarm output 1 ON delay | 0000 to 3600 | Sec | 0000 |
| A 1oF | Alarm1 OFF delay time | Alarm output 1 OFF delay | 0000 to 3600 | Sec | 0000 |
| AL-2 | Alarm2 mode | Alarm output 2 operation mode | oFF/ duCC/ ]]du/ ]duC CduC/ PuCC/ ]]Pu/ LbA SbA/ HbA | - | ]]du |
| AL2t | Alarm2 type | Alarm output 2 option/type | AL-A/ AL-b/ AL-C/ AL-d/ AL-E/ AL-F | - | AL-A |
| A2HY | Alarm2 hysteresis | Alarm output 2 hysteresis | 001 to 100 (000.1 to 100.0) | Digit | 001 |
| A2n | Alarm2 N.O./N.C. | Alarm output2 N.O./N.C. | no/nC | - | no |
| A2on | Alarm2 ON delay time | Alarm output 2 ON delay | 0000 to 3600 | Sec | 0000 |
| A2oF | Alarm2 OFF delay time | Alarm output 2 OFF delay | 0000 to 3600 | Sec | 0000 |
| AL-3 | Alarm3 mode | Alarm output 3 operation mode | oFF/duCC/]]du /]duC/CduC /PuCC/]]Pu /LbA/SbA/HbA | — | oFF |
| AL3t | Alarm3 type | Alarm output 3 option/type | AL-A/AL-b /AL-C/AL-d /AL-E/AL-F | — | AL-A |
| A3HY | Alarm3 hysteresis | Alarm output 3 hysteresis | 001 to 100 (000.1 to 100.0) | Digit | 001 |
| A3n | Alarm3 N.O./N.C. | Alarm output 3 N.O./N.C. | no/nC | — | no |
| A3on | Alarm3 ON delay time | Alarm output 3 ON delay | 0000 to 3600 | Sec | 0000 |
| A3oF | Alarm3 OFF delay time | Alarm output 3 OFF delay | 0000 to 3600 | Sec | 0000 |
| LbAt | LBA time | LBA monitoring time | 0000 to 9999 | Sec | 0000 |

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| Parameter | | Description | Set range | Unit | Factory default |
|---|---|---|---|---|---|
| LbAb | LBA band | LBA detection band. | 0000 to 999 (temperature H) | ℃/℉/% | 002 |
| | | | 000.0 to 99.9.9 (temperature L) | | 002.0 |
| | | | 000.0 to 999.9 (analog) | % | 000.2 |
| Ao.n1 | Analog output mode | Analog transmission 1 output value | Pu / Su / H-nu / C-nu | - | Pu |
| FS.L1 | Low out scale | Transmission output 1 low-limit value | F.S | - | -200 |
| FS.H1 | High out scale | Transmission output 2 high-limit value | F.S | - | 1350 |
| Ao.n2 | Analog output mode | Analog transmission 2 output | Pu / Su / H-nu / C-nu | - | Pu |
| FS.L2 | Low out scale | Transmission output 2 low-limit value | F.S | - | -200 |
| FS.H2 | High out scale | Transmission output 2 high-limit value | F.S | - | 1350 |
| AdrS | Unit address | Unit address. | 01 to 99 | - | 01 |
| bPS | Bits per second | BPS (bits per second) | 24 / 48 / 96 / 192 / 384 | - | 96 |
| PrtY | Parity bit | Communication parity bit | nonE / EuEn / odd | - | nonE |
| StP | Stop bit | Stop bit | 1 / 2 | - | 2 |
| rSUt | Response waiting time | Response waiting time | 5 to 99 | ms | 20 |
| ConY | Communication write | Communication write permission | EnA / diSA | - | EnA |


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## 7.7 Parameter 5 setting group [PAr5]

| Parameter | | Description | Set range | Unit | Factory default |
|---|---|---|---|---|---|
| nt.Su | Multi SV | Number of multi SVs | 1 / 2 / 4 | EA | 1 |
| dI-E | Digital Input Key Function | DI input key function on the front panel | StoP / RLrE / Rt / oFF | - | StoP |
| dI-1 | Digital Input 1 Function | DI-1 digital Input function | oFF / StoP / RLrE / nAn / nt.Su | - | oFF |
| dI-2 | Digital Input 2 Function | DI-2 digital Input function | | - | oFF |
| It.nu | Initial manual MV | Manual control baseline MV | AUto / Pr.nu | - | AUto |
| Pr.nu | Preset manual MV | Manual control initial MV | 000.0 to 100.0 (standard control) -100.0 to 100.0 (heating & cooling control) | % | 000.0 |
| Er.nu | Error MV | Sensor error MV | 000.0 to 100.0 (standard control) -100.0 to 100.0 (heating & cooling control) | % | 000.0 |
| St.nu | Stop MV | Control stop MV | 000.0 to 100.0 (standard control) -100.0 to 100.0 (heating & cooling control) | % | 000.0 |
| St.AL | Stop alarm out | Control stop alarm output | Cont / oFF | - | Cont |
| USEr | User level | User level | Stnd / HI GH | - | Stnd. |
| LC.Su | Lock SV | SV parameter lock | on / oFF | - | oFF |
| LC.P1 | Lock parameter 1 | Parameter 1 group lock | on / oFF | - | oFF |
| LC.P2 | Lock parameter 2 | Parameter 2 group lock | on / oFF | - | oFF |
| LC.P3 | Lock parameter 3 | Parameter 3 group lock | on / oFF | - | oFF |
| LC.P4 | Lock parameter 4 | Parameter 4 group lock | on / oFF | - | oFF |
| LC.P5 | Lock parameter 5 | Parameter 5 group lock | on / oFF | - | oFF |
| PYd | Password setting | Password setting | 0000: Password protection off. 0002 to 9999 | - | 0000 |

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## 7.8 Password entry parameter

| Parameter | | Description | Set range | Unit | Factory default |
|---|---|---|---|---|---|
| PASS | Password | Password entry. | 0001 to 9999<br>(0001: read-only) | - | 0001 |

## 7.9 Parameter change reset parameters

| Changed parameter | Description | Reset parameter |
|---|---|---|
| In-t | Input types | Su-n, AL 1.L, AL 1.H, AL2.L, AL2.H, AL 3.L, AL 3.H, SuO to Su3, db, H.HYS, H.oSt, C.HYS, C.oSt, rAnU, rAnd, r.Unt, L-rG, H-rG, dot, L-SC, H-SC, d.Unt, In-b, L-Su, H-Su, LbAt, LbAb, Ao.n1, FS.L1, FS.H1, Ao.n2, FS.L2, FS.H2 |
| Unit | Temperature input unit | With the exception of L-rG, H-rG, dot, L-SC, H-SC, and d.Unt, Input type does not affect input units. |
| H-Su | SV high-limit value | When SV>H-Su, SV resets to H-Su. |
| L-Su | SV low-limit value | When SV<L-Su, SV resets to L-Su. |
| o-Ft | Control output operation mode | L-nu, H-nu, C-nd, Er.nu, Pr.nu, St.nu |
| C-nd | Temperature control type | L-nu, H-nu, Er.nu, Pr.nu, St.nu |
| AL-1, AL-2, AL-3 | Alarm mode/option | AL 1.L, AL 1.H, AL2.L, AL2.H, AL 3.L, AL 3.H |


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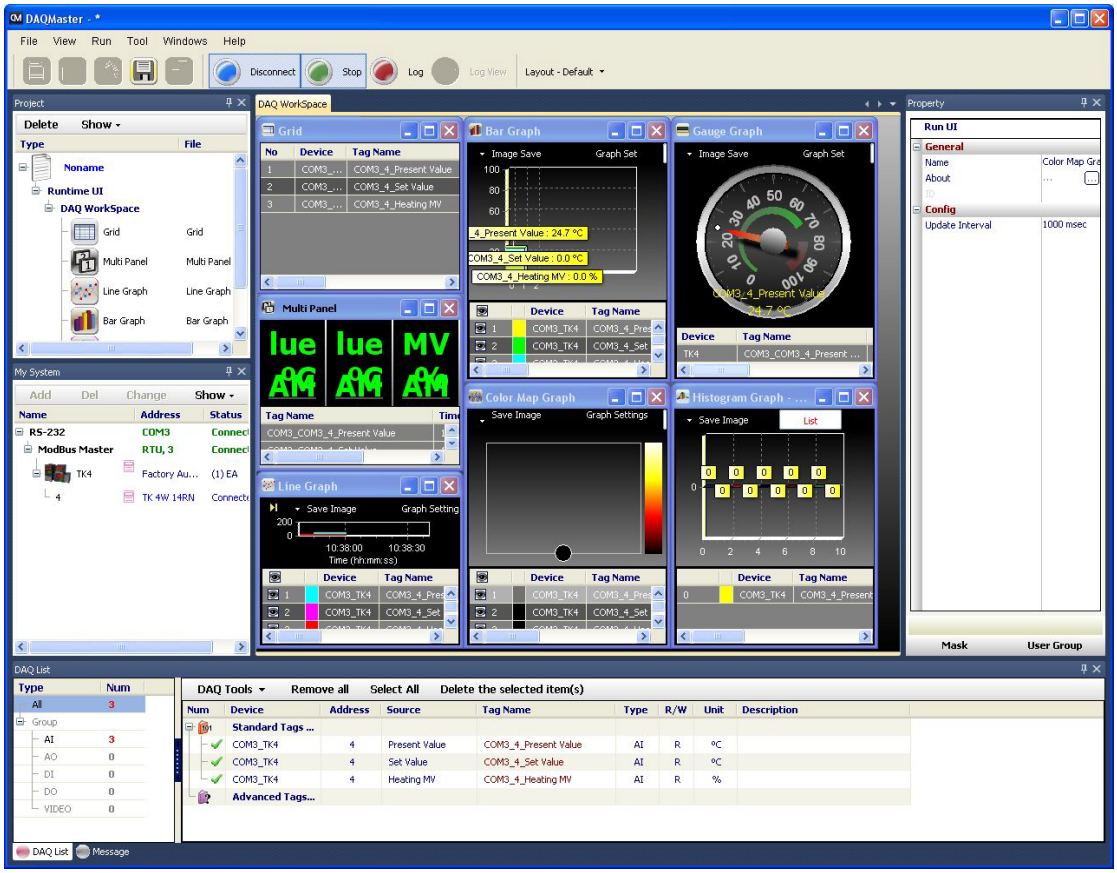
# 8 DAQMaster

## 8.1 Overview

DAQMaster is a comprehensive device management program that can be used with Autonics communication supporting products.

DAQMaster provides GUI control for easy and convenient management of parameters and multiple device data monitoring.




**Note**

For detailed information, please download a copy of the DAQMaster manual from the Autonics website.

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## 8.2 Major features

DAQMaster has the following features:

### (1) Multiple device support

- Simultaneously monitor multiple devices and set parameters.
- Simultaneously connect units with different addresses in a single device.
- Use Modbus Remote Terminal Unit (RTU) to enable the use of multiple RS232 ports.

### (2) Device scan

In cases of multiple units (with different addresses) connected together, use unit scan to automatically search for units.

### (3) Convenient user interface

Freely arrange the windows for data monitoring, attributes, and projects.
Saving a project also saves the screen layout.

### (4) Project management

You can save added device information, data monitoring screen layouts, and I/O source selection as project files. Open project files to load the saved settings.
Provides a project list for simple and easy project file management.

### (5) Monitoring data log

When monitoring, save data log files as either DAQMaster data files (.ddf) or CSV (.csv) files. Open files saved in the .csv format directly from Microsoft Excel.
Define log data file naming/saving rules and destination folders to make file management convenient.

### (6) Data analysis

Perform spreadsheet and graph analyses of .ddf data files using DAQMaster's data analysis feature. Save spreadsheet data as .rtf, .txt, .html, or .csv files.

### (7) Modbus Map table reporting

Print address map reports of registered Modbus devices. Modbus map table reports can be saved in .html and .pdf formats.

### (8) Multilingual support

Supports Korean, English, Japanese and Simplified Chinese.
To add a different language, modify the files in the Lang folder, rename, and save.

### (9) Script support

Uses the Lua Script language and deals with different I/O processes for individual devices.


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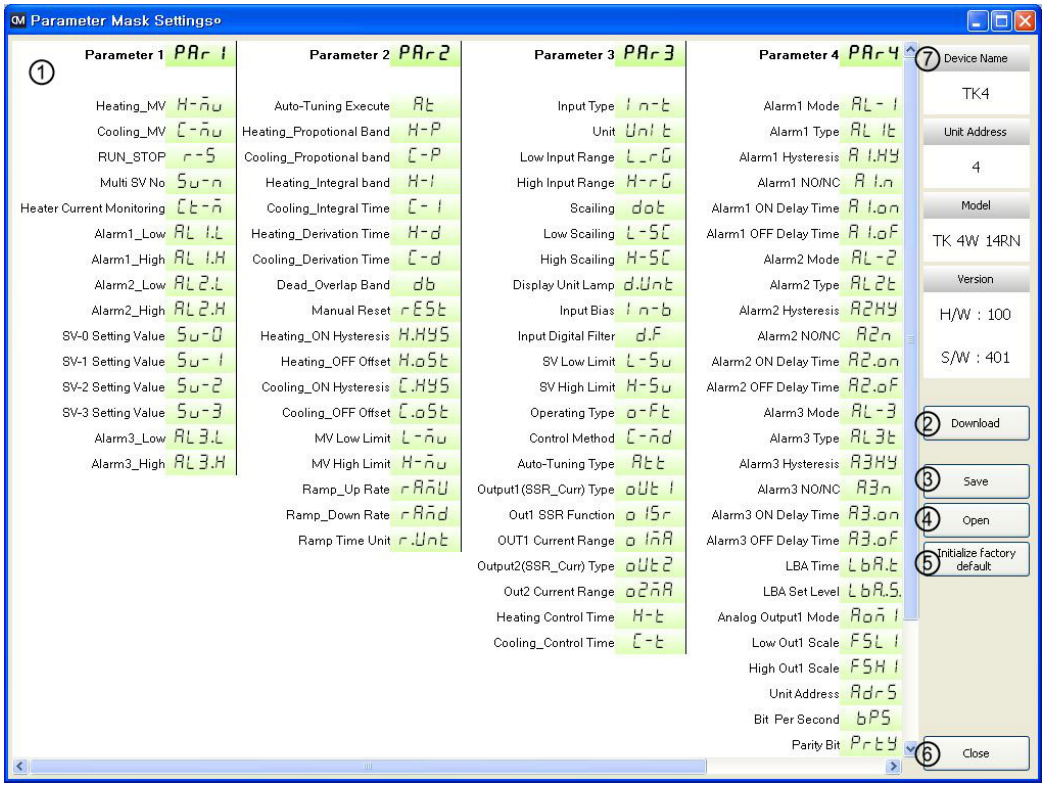
## 8.3 Special feature for TK Series

Parmaeter mask and user parameter group is available by DAQMaster. Visit our website (www.autonics.com) to download DAQMaster software and the manual.

### 8.3.1 Parameter mask

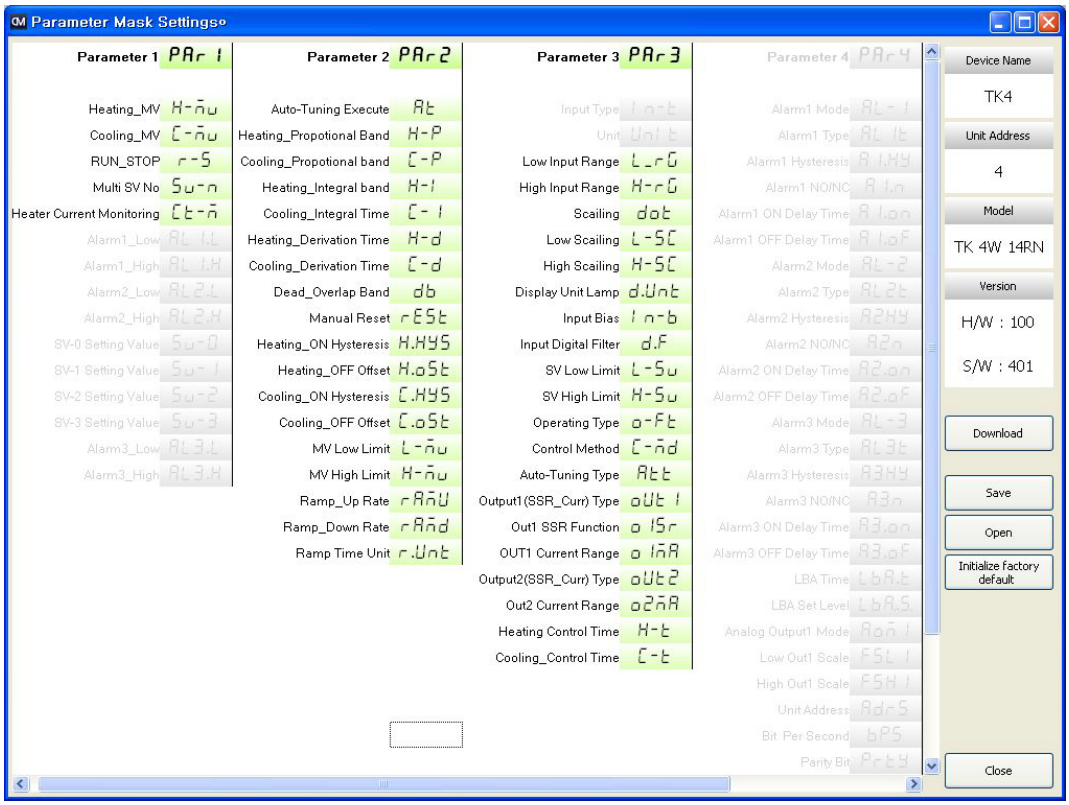
This feature is able to hide unnecessary parameters to user environment or less frequenctly used parameters in parameter group.

Masked parameters are not only displayed. The set value of masked parameters are applied.




| No | Item | Description |
|---|---|---|
| ① | Parameter mask selection | Select the to-be masked parameters.<br>Right-click the to-be masked parameters and they turn gray. |
| ② | Download | Applies the set masked parameters to the device. |
| ③ | Save | Saves the set masked parameters as a mask information file. |
| ④ | Open | Opens the saved mask information file. |
| ⑤ | Initialize factory default | Clears the set for the masked parameters.<br>Download this setting to apply it to the device. |
| ⑥ | Close | Closes the Parameter Mask Settings dialog. |
| ⑦ | Device information | Displays device name, unit address, model name, and version. |

Ex.




Example of masking alarm, SV setting parameters of parameter 1 group, input type, unit of parameter 3 group, and all of parameter 4 group.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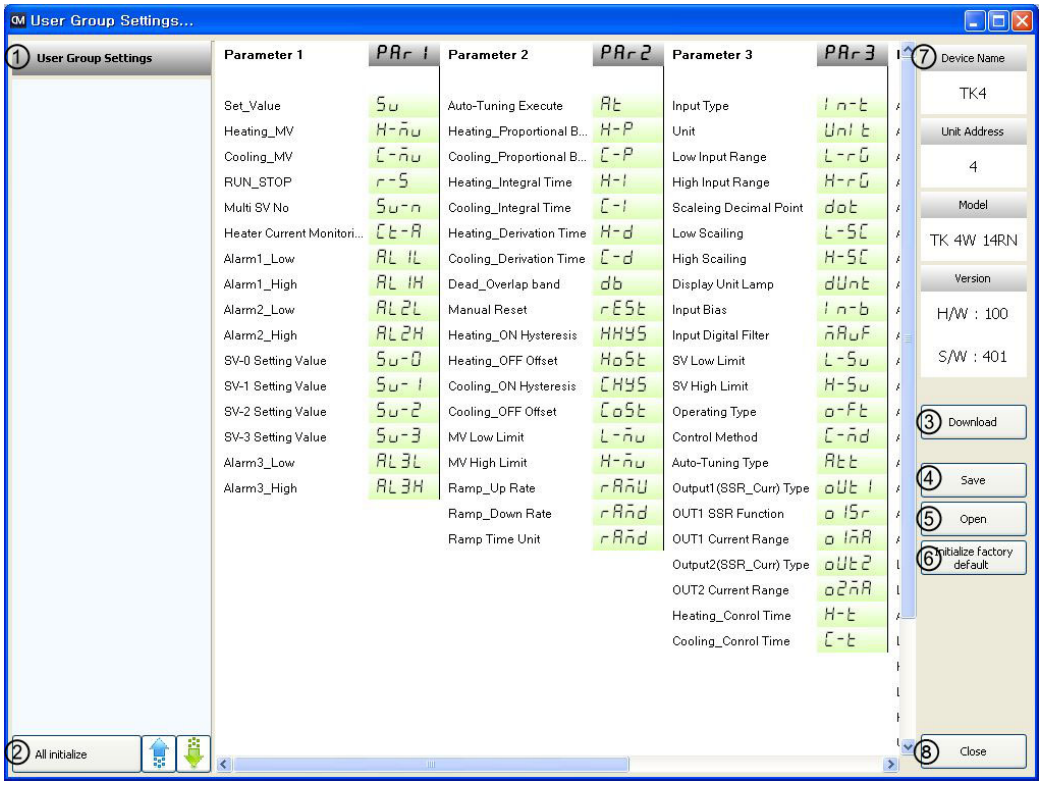
## 8.3.2 User parameter group [PArU]

This feature is able to set the frequently used paramters to the user paramter group. You can quickly and easily set parameter settings.
User parameter group can have up to 30 parameters.




| No | Item | Description |
|---|---|---|
| ① | User parameter group | Displays the selected parameters as user parameter group.<br>Double-click the parameters for the user parameter group, and these parameters turn gray.<br>To delete the parameters at the user parameter group, double-click the parameters. |
| ② | User parameter group selection | - All initialize: Initializes the set user parameter group.<br>- ↑, ↓: Changes the selected parameter order up/down. |
| ③ | Download | Applies the set user parameter group to the device. |
| ④ | Save | Saves the set user group as user parameter group information file. |
| ⑤ | Open | Opens the saved user parameter group file. |
| ⑥ | Initialize factory default | Clears the set for the user parameter group.<br>Download this setting to apply it to the device. |
| ⑦ | Device information | Displays device name, unit address, model name, and version. |
| ⑧ | Close | Closes the User Parameter Group Settings dialog. |

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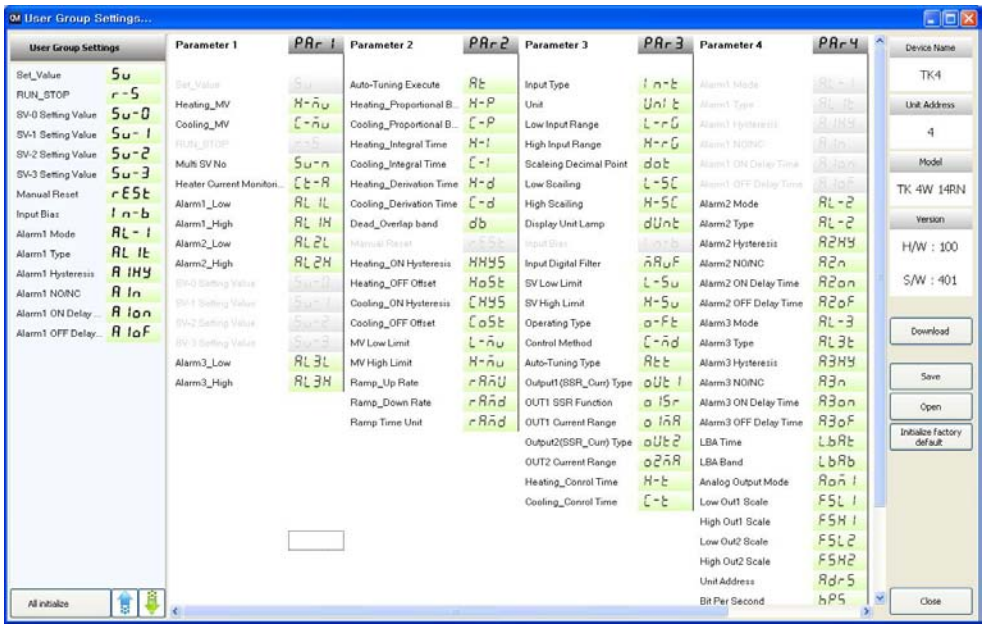
Ex.




Example of the set user parameter group with SV setting, control output RUN/STOP, alarm outptu 1 low/high-limit, SV-0/1/2/3 set value, manual reset, input correction, alarm output 1 mode/option/hysteresis/contact type/ON delay time/OFF delay time parameters.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# Autonics

Sensors & Controllers

www.autonics.com

## Distributor

■ **Major products**

- Photoelectric sensors · Fiber optic sensors · Door sensors · Door side sensors · Area sensors
- Proximity sensors · Pressure sensors · Rotary encoders · Connector/Sockets
- Switching mode power supplies · Control switches/Lamps/Buzzers · Temperature controllers
- Temperature/Humidity transducers · SSR/Power controllers · Counters · Timers · Panel meters
- Tachometer/Pulse(Rate) meters · Display units · Sensor controllers
- I/O Terminal Blocks & Cables · Stepper motors/drivers/motion controllers
- Graphic/Logic panels · Field network devices · Laser marking system(Fiber, $CO_2$ , Nd:YAG)
- Laser welding/soldering system

■ Any proposal for a product improvement and development: Product@autonics.com


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